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COMPLETE SYSTEM

OF

PRACTICAL ARITHMETIC,

(Both VULGAR and DECIMAL)

On an entire new Plan;

The DEFINITIONS, GENERAL RULES, and *many of the* EXAMPLES being VERSIFIED, and the whole made exceeding eaſy and familiar to the meaneſt Capacity, being done in ſuch a Manner as to render the Study of ARITHMETIC *delightful* as well as inſtructive to both Sexes.

TO WHICH IS ADDED,

A large Collection of NEW QUESTIONS, with only the ANSWERS thereto;

The other EXAMPLES, or QUESTIONS, being many of 'em work'd at full length.

By THOMAS SADLER.

Teacher of the Mathematics in *Whitchurch, Shropſhire.*

Author of the *Harveſt Field Poem*, and of ſeveral *Poetical* and *Mathematical Miſcellanies*, &c.

ARITHMETIC that uſeful curious Art
Refines the Man and brightens ev'ry Part
ARITHMETIC! by thy all pow'rful Aid
Wealth is ſecur'd and all the Fruits of Trade
We learn by FIGURES to demonſtrate true
And reaſon juſt by Precepts ever new.

SHREWSBURY:

Printed for the AUTHOR, by W. WILLIAMS.

And ſold by all *Bookſellers* in Town and Country.

M, DCC, LXXIII.

ADVERTISEMENT.

For the Benefit of Youth, and other Persons who are desirous of being instructed in the most useful parts of the Mathematical Sciences.

THE AUTHOR of this Treatise, begs leave to acquaint his Friends and the Public, that he will continue (if health permit) to teach WRITING in all the hands practised in *Great-Britain*, ARITHMETIC (*Vulgar* and *Decimal*, according to the plan of this Treatise, by which he will engage to bring Youth on to the knowledge of Figures, in half the time taken up by some Teachers.) BOOK-KEEPING, GEOMETRY, TRIGONOMETRY, MENSURATION in all its various parts, GAUGING, DIALING, GEOGRAPHY, and the use of the GLOBES; (*having purchased a new pair for that purpose*) ALGEBRA, FLUXIONS, ASTRONOMY, and NAVIGATION, according to the best Methods used by the most celebrated Authors.

Note. Gentlemen's Estates Surveyed, and Mapped in the best manner, Marl-pits and Hay-recks Measured, and all kinds of Artificers' Work, by the *Author*, (on reasonable terms) by whom Youth will be made fit for Sea, Excise, or any public Office, *&c. &c.*

To the Honourable Sir WATKIN WILLIAMS WYNNE, *Bart. and Knight of the Shire, for the County of Salop.*

HOND. SIR,

THE Conſideration of that *glorious Family* from which You ſpring, which has ever ſtood foremoſt in the Patronage and Support of whatever may be deem'd beneficial, or uſeful to the Public Weal, joined to that Candour and Urbanity which You ſo eminently poſſeſs, emboldens the Author of this *Arithmetical Treatiſe*, humbly to beg leave to *ſhelter it under* YOUR PATRONAGE, which he hopes will be found to be formed upon a Plan at once eaſy, uſeful, and pleaſant; and in ſhort, to anſwer the end the Author intends, which is to

lead

lead Youth in an agreeable manner, to the ſtudy of a thing of ſuch public and private Utility. Theſe ends the Author flatters himſelf will be anſwered by a careful peruſal of the following Sheets, by thoſe for whoſe Uſe they were principally drawn up, *viz.* the *Tyros* in *Arithmetic*, ſeveral Gentlemen eminent in the Mathematics having peruſed them with Approbation.——Not to treſpaſs upon YOUR HONOUR's Time, and to wave the hacknied Track of Dedication, (tho' I cou'd dilate with pleaſure upon the *admired Character* of *Sir* WATKIN WILLIAMS-WYNNE) I beg leave to ſubſcribe myſelf

YOUR HONOUR's moſt obedient,

humble Servant,

T. SADLER.

THE PREFACE.

THE uſe of ARITHMETIC is ſo great in all common affairs of life, and amongſt all degrees of people, that no man can ſay without erring from truth,—"ARITHMETIC *is of no uſe, or conſequence to me, I mind it not.*" The *Stateſman*, even an *Emperor* himſelf muſt call in *its aid* at certain times, and upon ſundry occaſions. If it were not for the knowledge of *Figures*, what wou'd become of Trade, Commerce, *&c.*

What induced me to write a Treatiſe of PRACTICAL ARITHMETIC after ſo many excellent Authors who have wrote before me, were the following motives.

Firſt, I obſerved none had attempted to write upon the plan I offer to the public, *i. e.* of verſifying the general Rules for the eaſe of Memory. And Secondly, few had given the Operations work'd at Length: This was an article I have heard a great many complain of, even Teachers themſelves.

As to the Work itſelf, it is laid down upon the beſt foundation I cou'd procure from the moſt celebrated Authors; the Rules (tho' *verſifie'd*) are built upon the beſt principles now taught and practiſed by the moſt eminent Maſters of our private or public Academies, or Schools in this Kingdom; every difficulty is explained in the moſt conciſe and beſt methods, and the whole of the performance made perfectly eaſy to be underſtood, (even by the meaneſt capacities) by precepts ſo naturally eaſy, as to lead Youth on without the help of any other Inſtructor.—By the help of this Treatiſe, any young man of a

tolerable capacity, may in a ſhort time make himſelf maſter of the moſt difficult parts of ARITHMETIC.

I have often obſerved many young people of the lower claſs, (whoſe parents were not able to give them a proper Education) have by their own Induſtry, Ingenuity, and the help of good Authors, become very good Accomptants, got preferment, and advanced themſelves to very great fortunes. It muſt be allowed to be no ſmall difficulty for a perſon in a ſervile ſtate, who earns his bread (perhaps) by the ſweat of his brow, to make much proficiency in the Sciences, but where wou'd all the *Mæcenaſes* of the age be, if the few ſpare hours allotted to ſleep were not on their ſide? To anſwer which we'll ſay, "buried in oblivion."—But it is well known from the writers of all ages, that the *Goddeſs of Wiſdom*, does not always deſcend in a golden ſhower, or crown her favourites with diadems and coſtly pearls. No! rather with knowledge, for even the loweſt and meaneſt Cottager may wear her Laurels, as ſoon as the greateſt Monarch upon Earth. This I hope every impartial Reader will allow; to favour which, I ſhall give a quotation from a letter I received many years ago, from a learned gentleman (Mr. *Tarrat* of *Epſom*) whoſe name is well known to the public. "*A perſon's elevation*" (ſays my friend) "*moſtly ariſes from acci-*
"*dents.*——Ferguſon *is a ſelf taught Philoſopher.*——
"Martin *the ſame.* Simpſon *was a very poor Weaver,*
"*and by an extraordinary accident was brought to*
"London, *and introduced to the Academy of* Wool-
"wich. Thomas Grimmet, *a Ship Carpenter in the*
"*Yard at* Deptford, *by an accident of a broken thigh,*
"*was introduced to copy Accounts in an Office, became*
"*a very good Mathematician, a Meaſurer in the Yard*
"*and died worth £14000, a few years ago; I could*
"*enumerate five hundred inſtances if I had paper,*
"*room and time.*"

It

It may be ſaid with regret, that too little regard is paid to *both ſexes*, (eſpecially the *female*) in inſtructing or having them inſtructed, by perſons properly qualified for ſuch a purpoſe, in ſo noble, ſo extenſive, and uſeful a branch of learning as ARITHMETIC. —— "ARITHMETIC," (ſays the celebrated Mr. *Malcolm* †) "*is a ſubject of that extent, that in ſome* "*reſpects* it *can never be exhauſted, and of that value* "*as to deſerve all that ſtudy and pains that can be* "*beſtowed upon* it." Mr. *Emerſon* ſays alſo, "*No* "*Buſineſs can be carried on without the help of* NUM- "BERS, *no Trade or Commerce exerciſed without* "REGULAR ACCOMPTS, *ſo that in all ſituations of life,* "ARITHMETIC *is a neceſſary accompliſhment.*" Mr. *Locke* ſays in his Eſſay on Human Underſtanding, "*All thoſe ſhould be taught who have time and op-* "*portunity, the Art of* NUMBERS, *not ſo much to* "*make them Mathematicians, as to make them rea-* "*ſonable Creatures*: What a true conception of the powers of ARITHMETIC poſſeſſed *Solomon*, when he uttered that juſt aſſertion. "*Thou O Lord hath diſ-* "*poſed all things in Meaſure, Number and Weight.*" From the above citations we behold the intrinſic value of NUMBERS, in the words of the greateſt Philoſophers that ever exiſted, whoſe monuments of refined knowledge will ſtand the teſt of all ages. Then what a pity it is, that parents whoſe abilities and fortunes will enable them, would be careful to have their children well inſtructed in ſuch neceſſary attainments.

It is well known that the genius of the *fair Sex* is as penetrating as ours, a Lady of fortune by the help of NUMBERS, can adjuſt her accompts with her Steward; alſo, the Mechanic, Tradeſman, or Farmer's Wife is able to book and accompt in her Huſband's abſence. To encourage my Female Readers, I ſhall

† *In his Preface to his* Arithmetic, *page* 1.

give

give them a Poetical Opinion of a *learned Lady*, from one of her Letters of Correſpondence written to me ſome years ago. She deſcants thus,

" *How few alas! in this degen'rate age,*
" *Employ their noble faculties, and pow'rs*
" *In ſcientific knowledge, — rich ſupplies*
" *From thence we draw; nor will the Fountain ceaſe*
" *To flow, 'till time itſelf ſhall be no more,*
" *And nature ſinks beneath the gen'ral fire.*

PHILLIPS."

Having for a ſeries of upwards of twenty years taken great delight in reading the Annual Publications, *viz.* the Diaries, Palladiums, and ſuch delightful Miſcellanies, I have obſerved the Queſtions (tho' ever ſo intricate to be ſolved) when humouroufly verſified have tended greatly to the amuſement of *both ſexes*, only for the reading part; much more entertainment muſt they give to the ingenious *Tyro* who can ſolve them. This was one motive why I propoſed ſo many Examples in this Treatiſe in Verſe, I did it purely to excite the learners attention to the ſtudy of FIGURES, or ARITHMETIC; to mix knowledge with delight, and by that means entice as it were the ingenious learners to climb the moſt difficult precipice with pleaſure. I think nothing can ſtrike a deeper impreſſion upon the mind, than having the Rules delivered in Verſe, and learned perfectly by heart; this not only ſerves the preſent purpoſe, but is much ſtronger retained in memory, than a page of dry proſe writing; not by children only, but by adult perſons alſo.

The Queſtions in Verſe as they are humourous and innocent, I hope they will be looked upon alſo, as proper and agreeable recreations for *both ſexes*.—— Some of theſe Queſtions perhaps may be thought too long for a Maſter to copy out to his Pupils, but this

is

is quickly remedied, by giving the ſubject of the Example in Proſe; but more delightful, as well as beneficial it will be, for the ingenious Pupil, to write or copy theſe out himſelf, as well as the Definitions and Rules: all this will add to a creative mind, and improve the uſe of the PEN, as well as FIGURES.—— It is a thing almoſt impoſſible for Maſters (even of the ripeſt judgment) in large Schools to teach without the help of an Author; or, even when there are ſeveral Pupils waiting with their performances to be examined, to perform their duty, without having the operations at hand to what they propoſe, by having the whole operation immediately open to the eye an error is ſoon diſcovered, and a deal of time ſaved; it is true when a Maſter knows the Anſwer, and his Pupil is wrong, he may check him, bid him go and find it out, but this will only curb his ingenuity, ſtupify his ſenſes, loſe his time, and be detrimental both to himſelf and Parents. In my humble opinion nothing comes up to encouragement, by giving youth a proper idea of the matter they have in hand, and then they will go thro' their performances with eaſe and perſpicuity; according as their genius or inclination may lead them.

Perhaps ſome of our moſt eminent Teachers and Mathematicians may ſay, I have inſerted too many operations at length, as this may be a means of encouraging dull and lazy boys to copy out their Anſwers, and by that means think to deceive the Maſter, but ſuch kind of piracy may ſoon be detected. To remedy this, I have added a compleat collection of new Queſtions at the end of this Treatiſe, in every Rule, with only the Anſwers. Any of theſe Queſtions when given to the Pupil will ſoon put him to a ſtand, make him reflect on what he has done, and ſet his thoughts to work, to enquire into the true principles and nature of working his Queſtion, as *per*

Rule

Rule, but it wou'd be in vain to give a Pupil any of the Queſtions before he has got a perfect knowledge of the Rule to which they belong.

In this place I cannot help taking notice of the great uſe this Treatiſe muſt be, to thoſe perſons who have not time and opportunity, (and perhaps cannot afford) to have a Maſter's inſtruction; here they will ſee how every Example is, or ought to be done; and may quickly by their own application, make themſelves complete maſters of the whole Treatiſe.—Thoſe perſons alſo, who have negligently forgot what they have learned at ſchool, may here quickly regain what they have occaſion for, according as their buſineſs or ſituation may require.

As to the order of the Rules in this Treatiſe, I have placed them as I thought moſt properly they ſhou'd be learned; but every Maſter may uſe his own pleaſure, and teach them in what form he likes beſt.

I have obſerved many good Authors take the method of tranſcribing many of their queſtions from other men's writings, without mentioning the name of the real Author, or to whom they were obliged for them; this is rather an unfair way of proceeding, in my opinion every author ought to ſhine in his own plumes; this occaſioned my inſerting the Authors names to the Promiſcuous Queſtions, &c. In regard to propoſing new Queſtions in ARITHMETIC, I muſt confeſs, it is almoſt impoſſible to frame any thing new, but what ſhall be ſimilar to what has been wrote before by others; becauſe the uſe and application of FIGURES is the ſame as in former ages; but then it muſt be allowed that new improvements have and will be made, and a new dreſs given to every Man's performance, perhaps as long as this world ſhall exiſt.

I muſt certainly expect, (when even the beſt of Authors,

thors, and moſt celebrated Mathematicians have done the ſame) to be carped at by ſome ill natur'd Critics, who wou'd endeavour to *throw down a Caſtle*, if but *one Stone* ſtood crooked in the *whole fabric*; but this will make but little impreſſion upon me, as I do not, pretend to ſuch niceties. What I have done is purely for the benefit of the unlearned, and the inſtruction of our *Britiſh* Youth.—So I hope every impartial reader, and lover of truth, will judge for himſelf of the merits of this Performance; and if it meet with the approbation of my worthy ſubſcribers, and the public in general; I ſhall not think I have ſpent ſo much labour in vain, but rejoice at having done any thing that may be ſerviceable, and for the good of my country.

By reaſon of the many indiſpenſible avocations which prevented me from attending the preſs, my judicious Readers may perhaps find a few typographical errors and ſlips of the pen, which are ſcarce poſſible to be avoided in printing ſo large a Treatiſe as this; therefore (and as I have drawn up no *Errata*) I hope they will candidly excuſe and correct what errors they may occaſionally find herein, and that, as well as all other favours ſhall be gratefully acknowledged by

Whitchurch *their moſt obebient humble Servant*
April 25th, 1773. THOMAS SADLER.

On the Excellence and extenſive Uſe of ARITHMETIC.

Hinc omne principium, huc refer exitum. Hor.

THE path by which aſpiring mortals climb
To Wiſdom's Fane, and compaſs truths ſublime,
I ſing —— *Caſtalian Maids!* inſpire my ſong,
Soft let the tuneful numbers roll along
As Spring-gales wafted from *Favonious'* wings,
And ſweet as ſounds that flow from *Delphian* ſtrings.
ARITHMETIC's my theme!—O heav'n born Fair!
(If ſcience merit thy diſtinguiſh'd care)
Thou, *Pallas*, aid!—— to heights untry'd before,
Indulgent Goddeſs! teach my thoughts to ſoar.
ARITHMETIC! —— The name can re-inſpire
The languid *Muſe*'s half-extinguiſh'd fire:
Oh! cou'd that *Muſe* on Eagle's pinions riſe,
From this low Earth to yon' cerulean Skies;
Amidſt ſiderial worlds *thy* praiſe I'd ſing,
And with *thy* fame the diſtant ſpheres ſhou'd ring.
ARITHMETIC! to *thee* we juſtly owe,
Whate'er of Arts, or Sciences we know;
From *thee* they ſpring, —— on *thy* ſupport depend;
Thou art their *Primum Mobile*—— and end.
Thy various uſeful properties are known,
In ev'ry diſtant land from *Zone* to *Zone*,
Where truth prevails, and erudition's ray,
Darts on the ſoul, and yields a mental day:
But *Britain*'s firſt thy juſt applauſe to ſound,
Britain, not leſs for arts than arms renown'd.
By *thee* her *NEWTON* roſe aloft to fame,
And as the ſtars immortaliz'd his name,

By

By *thee* fair *Commerce* lives, and kindly pours
Un-number'd bleſſings on her ſea-lav'd ſhores:
With majeſty benign the Goddeſs ſmiles,
And crowns with opulence the *Queen of Iſles.*
Daughter of *Concord! thee Britannia* hails,
Whoſe glories blaze beneath thy foſt'ring ſails,
Whence to her temp'rate climes the fruits are hurl'd,
Of hot *Golconda*, and the *Polar World.*——
ARITHMETIC! without thy pow'rful aid,
Could Reaſon's keeneſt eye the gloom pervade,
Where white-rob'd Truth her lovely form enſhrouds,
And veils her face in ſcientific clouds?
Reaſon unaided, at the beſt we find,
The dawn of knowledge on the human mind;
But by *thy* pow'r the faculty divine,
Improv'd with ſtronger rays begins to ſhine;
From truth to truth *thy* precepts point the way,
'Till the weak twilight brightens into day.
So when hot *Sol* from *Thetis'* cold embrace
Aſcends, and in the Eaſt unveils his face,
The gloomy ſhades recede before his eye,
And perfect day-light blazes thro' the ſky.
All hail, BLEST ART!—— but Oh! my feeble lays,
Degrade *the ſubject* I attempt to praiſe:
A theme ſo great — ſo noble, does require
A *POPE*'s pure diction, and a *MILTON*'s fire.
Great *EMERSON*, whoſe energetic ſoul
No ſpace can bound—no obſtacle controul;——
Whoſe learning will to lateſt ages ſhine,
And ſtamp his name with honours half divine;
Expatiates with delight, and ſtill profound
O'er all th' extenſive mathematic round:
But where had been his fame without *thy* aid?
Interr'd beneath Oblivion's ten-fold ſhade!
'Twas *NUMBERS* gave his mighty genius birth,
And made his thoughts aſpire above the Earth.
Fam'd *HUTTON* too, in ſcience deeply taught,
With all his vaſt profundity of thought,

Without the help of *NUMBERS* ne'er had ſhone,
Or made his curious, uſeful The'rems known.
By *NUMBERS* taught the *Bards* divinely ſing,
And by ſoft *NUMBERS* charm the Lyric ſtring.
PARENT of ARTS! (eſteem'd by great and ſmall)
Whoſe wide, unbounded uſe extends to all;
'Tis *thine* to teach, and beautify the mind,
'Tis *thine* to bleſs, and dignify mankind;
——*Thine* by un-erring rules to aſcertain
The Merchant's treaſure, and the Tradeſman's gain.
'Tis *thine*—— but Ah! my utmoſt efforts fail,
Thy worth—*thy* countleſs merits to reveal:
'Tis not in language leſs than that divine,
To tell what matchleſs excellence is *thine!*
Hence may *thy Rules*, by *SADLER's* mode explain'd,
Be learn'd with pleaſure, and with eaſe retain'd:
Hence *thy* Examples more and more admir'd,
And *Britiſh* youth with emulation fir'd,
Purſue *thy* precepts, with renew'd delight,
'Till taught to reaſon well, and judge aright:
So ſhall *Minerva* crown their glorious toil,
And raiſe an *Athens* in her fav'rite Iſle.

BENJAMIN WEST.

Weedon-Beck in *Northamptonſhire*,
January 15th, 1773.

LETTERS of RECOMMENDATION.

To Mr. THOMAS SADLER, *on his New Syſtem of* PRACTICAL ARITHMETIC.

SIR,

UPON a peruſal of your *Arithmetic*, I think it incumbent on me, (as a well-wiſher to the literary world) to recommend it in the moſt expreſs terms,

terms, as the moſt uſeful, ingenious (conſidering the verſification) and elegant performance I have met with, not only for initiating youth into *Arithmetic* (as the Queſtions are many of 'em wrought at length) but uſeful alſo for ſeveral Schoolmaſters, who having had no liberal education, are often deficient in the true methods of Solution. To all ſuch I recommend it ſincerely, and hope it will be found a very uſeful and valuable Manual; —and that you may have all the encouragement due to ſuch a performance, is the hearty deſire of

Your humble Servant and Well-Wiſher;
P. ANTROBUS.

In Authoris laudem, et opera ejus.

YOUR Book needs not require a greater fame,
Than bear the title of *T. SADLER*'s name;
Let *Zoilus* alone, his envy's far below
That art you here unto the world do ſhew:
The pious *Watts* with all his ſacred lays,
Was he now living cou'dn't augment your praiſe,
So fam'd your works; friend *SADLER* may you ſtill,
Go on to write, as you've begun with ſkill:
And may your future arts reſound in praiſe
More noble, and ſublime than bards can raiſe.

Corripe lora manu, nec ſit mutabile pectus
In te, conſiliis utere tuque tuis,
Macte tua ſic Arte brevi facis iter ad Figuras
Arithmeticæ *pandis commodius que vias;*
Tu elementa prima; Tu tota opera quoque
Numerandi doces, perge, et amice vale.

P. ANTROBUS.

Dabem de Schola Middlewich,
in Provincia ceſtrenſi pridie
Nonas Januarii, anno poſt
Natum Chriſtum; 1773.

To Mr. THOMAS SADLER *on his New Treatiſe of* ARITHMETIC.

SADLER! thy genius makes the world admire,
And wonder how ſuch art thou didſt acquire
To write ſo well, digeſt thy rules ſo clear,
Herculean labour, to compleat what's here
With ſo much truth, laid down conſpicuouſly,
For th' uſe of man! ſo graceful to the eye. ——
But well I know, that an induſtrious mind
Makes hard things eaſy, to inſtruct mankind.
Thanks, thanks, my friend, are for thy labours due,
Candour ſays ſo, and Fame reports it true,
Thou haſt preſcribed here, a noble plan,
To charm the youth, t'invite th' unlearned man,
To taſte of '*RITHMETIC*'s moſt uſeful ſtore,
Worth more intrinſic, than all *India*'s ore.
With pen and ink, *it*'s value none can write,
Nor can the thought of man the ſame indite,
Great places, and preferments are attain'd,
By thoſe who in *it*'s art, have knowledge gain'd.
Hail ſprightly youths! theſe pages learn with ſpeed;
And richer ornaments will ſoon ſucceed.
Ye ſoft, engaging, lovely fair! attend,
Here's pleaſure with inſtruction nicely penn'd.
ARITHMETIC in verſe, here, here alone we view,
Compil'd with ornament, quite modell'd new.
In ev'ry page, throughout this work we find,
Fit, curious queſtions, to improve the mind
Of youth, and age, whoſe early days' paſs'd by,
Unmindful of *this* uſeful, rich ſupply,
Without *whoſe* aid, the Merchant muſt reſign,
All trade at home, and to each diſtant Clime;
The meaner Tradeſman readily will own,
His buſ'neſs without *it*, cou'd not go on.
By this it's plain th' ALMIGHTY has conſign'd,
The art of *NUMBERS* to improve mankind,

In

In trade, and commerce, which on golden wings,
Bear wealth immenſe t'adorn the Throne of Kings.
Then let not envy's baneful tongue pretend,
To blaſt this Work, with *good intention* penn'd:
Nor let the *Critic* with ungen'rous mind
Deſpiſe the whole, if he by chance ſhou'd find
A few ſmall errors, but to mind recall,——
We err by cuſtom, ſince old *Adam*'s fall.
May'ſt thou my friend, meet merit's juſt reward
For ſuch great labour, penn'd with due regard,
T'inſtruct the age in *NUMBERS* and prepare
The youth for buſineſs with the ſtricteſt care,
Oh! may'ſt thou be rewarded for thy pains,
And wear the *Laurel* that true merit gains.

JOHN HOPLEY.

Occleſtone near *Middlewich*,
February 1ſt, 1773.

To Mr. THOMAS SADLER *on his New Syſtem of* PRACTICAL ARITHMETIC.

SIR,

YOUR Treatiſe of *Arithmetic* is truly a very excellent performance, and I have, and ſhall recommend it as the moſt ingenious piece extant, in our language, upon the ſubject, and heartily wiſh you all the encouragement due to ſo meritorious an undertaking, and am Sir,

Your very humble Servant,
NATH. BROWNELL.

Coventry Mathematical
School, Feb. 4th, 1773.

To Mr. THOMAS SADLER, *on his New* ARITHMETICAL SYSTEM.

SIR,

I Greatly approve of your *Arithmetical Syſtem*, and if my recommendation of it ſhould be thought of any ſervice to you, it will afford me infinite pleaſure to declare my ſentiments to the world, of a work that in my opinion, juſtly entitles you to the thanks and applauſes of all perſons engaged in the inſtruction of youth, in ſo uſeful and neceſſary a branch of learning. I am Sir, wiſhing you ſucceſs,

Your humble Servant,
BENJAMIN WEST.

Weedon-Beck, in *Northamptonſhire*,
February 5th, 1773.

To Mr. THOMAS SADLER, *on his New and Ingenious Treatiſe of* PRACTICAL ARITHMETIC.

SIR,

YOUR laſt I receiv'd, together with the ſheets of your *Arithmetic*, I exceedingly like your plan of proceeding, as 'tis not only uſeful, but even very entertaining both to youth and thoſe of riper years. The whole of your work is handled in a maſterly manner, which doubt not will render it a favourable reception to the public; for my part, ſhall introduce it to my pupils as the beſt of the kind extant, and am, (wiſhing your ſucceſs in all your undertakings)

Sir, Your ſincere Friend,
and humble Servant,
WILLIAM GOUGH.

Elleſmere,
March 12th, 1773.

To

To the PUBLIC.

WE whoſe Names are hereunto ſubſcribed, having peruſed the Plan of this ingenious Treatiſe of *Practical Arithmetic*, beg leave to recommend it as the moſt Inſtructive (as well as delightful) Book we have ſeen upon the ſubject, and think it worthy the greateſt Encouragement from all *Ranks* and *Degrees* of People.

Edward Hamnet, Newhall,
William Eccleſhall, Tarporley,
Charles Harding, Congleton,
Jonathan Worſenyroſt, Stockport,
Thomas Holland, Norbury,
} Philomath. { *Cheſhire.*

Iſaac Tarrat, Epſom,
Gervas Adams, Alvaſton,
} Philomath. { *Surry.* / *Derbyſhire*

Matthew Clemenſon,
Richard Suddones,
Joſeph Becconsfield,
John Pinnington,
Arthur Burns,
Samuel Hodgkin,
William Swift,
John Salt,
William Breeſe,
Humphry Davies,
} Writing Maſter and Teacher of the Mathematics at
{ Cheſter,
Chetford,
Tarporley, *Author* of Geodeſia Imp'd.
Burwardſley.
Stow near *Lincoln*,
W-hampton, *Staff.*
Adderley,
Aſton,
} *Shropſhire.*
} *Cheſhire.*

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EXPLANATION of CHARACTERS.

Signs.	Names.		Significations.
+ *Plus* / − *Minus*	or *more.* / *leſs.*	The Sign of	Addition as 5+4 is 9. / Subtraction as 8−3 is 5.
× *Multiplied into or by*			Multiplication as 6×4 is 24.
÷ *Divide by*			Diviſion as 12÷4 is 3.
= *Equal to*			Equality as 7+5=12,

: / :: *Is to* / *So is* — The Signs of Proportionals as 6 : 9 :: 12 : 18.

$\sqrt{}$ *Extraction of the Roots* — The Square Root of 9 is $\sqrt[2]{9}=3$ and the Cube Root of 27 is $\sqrt[3]{27}=3$.

$\frac{8-3\times 4}{5}=4$. for 8 leſs 3 multiplied by 4 and divided by 5=4.

NOTATION OF NUMBERS.

NOTATION teacheth to expreſs
Numbers in value, more or leſs;
Ten Characters will form complete,
What ſums you want tho' e'er ſo great.

NUMERATION TABLE.

							1	Unit.
						2	1	Tens.
					3	2	1	Hundreds.
				4	3	2	1	Thouſands.
			5	4	3	2	1	T. of Thouſands.
		6	5	4	3	2	1	C. of Thouſands.
	7	6	5	4	3	2	1	Millions.
8	7	6	5	4	3	2	1	T. of Millions.
9	8	7	6	5	4	3	2	1 C. of Millions.

IN this Table each Figure from the place of Units, increaſeth in a tenfold proportion; as 1 in the firſt place is unit or one; 2 in the ſecond place, is two Tens or Twenty: 3 in the third place is three Hundred and ſo of the reſt.

When large Numbers are expreſſed by Figures, for the more eaſy reading of them; let them be divided from the right-hand towards the left into Periods, and half Periods, each Period to contain ſix Characters or Figures, then the firſt Period will be Units or Ones, the ſecond Millions, third Billions, fourth Trillions, fifth Quadrillions, and ſixth Quintillions, as below.

Note, the firſt half of any Period, are ſo many Units, the latter half ſo many Thouſands of

Quintillions.	Quadrillions.	Trillions.
th. un.	*th. un.*	*th. un.*
123, 456.	123, 456.	123, 456.
Billions.	Millions.	Units.
th. un.	*th. un.*	*c.x.t. h.t.u.*
123, 456.	123, 456.	123, 456.

To expreſs in Figures any Number propos'd in words, and to expreſs in words, any Numbers propos'd in Figures, obſerve to get by heart the following

RULE.

In Words when you've the given ſum,
Fix Cyphers and the anſwer'll come,
And when in Figures 'tis no more,
But count them from the Table o'er.

EXAMPLE I.

What is five in the fifth place, ſix in the ſixth place, ſeven in the ſeventh place, eight in the eight place, and nine in the ninth place of the Table?

By

By annexing Cyphers to each Number, according to their places in the Table, we have theſe given Numbers, Viz.

50000
600000
7000000
80000000
900000000

to 987650000

which Numbers being all wrote down, according to the places where they ſtand will be equal *i. e.* in words, nine Hundred Eighty ſeven Million, ſix Hundred and fifty Thouſand.

EXAMPLE 2.

Expreſs in Figures, Eighty Thouſand four Hundred and forty.

h. t. u.
80,000
400
40

80440

EXAMPLE 3d.

How do you write down ſeventeen Millions, ſeventeen Thouſand, ſeventeen Hundred and ſeventeen?

17000000
17000
1700
17

17018717

EXAMPLE 4.

Expreſs in Figures forty-five Billions, four Hundred, forty-five Thouſand and four Millions, ſixty Thouſand. ſix Hundred and fifteen.

45,000,000,000,000
445,004,000,000
60,000
600
15

45,445,004,060,615

EXAMPLE 5.

Write down in Words, 34167. Begin at the right-hand in the place of Units, and count them as per Table, and they will be read thirty-four Thouſand, one Hundred and ſixty-ſeven.

Ex-

EXAMPLE 6.

Write in words 909090909. Anſwer. Nine Hundred and nine Millions, ninety Thouſand, nine Hundred and nine.

A SYNOPSIS of the ROMAN NOTATION.

1 =I	70=LXX
2 =II	80=LXXX
3 =III	90=XC
4 =IIII or IV.	100=C
5 =V	500=D or I$\supset$
6 =VI	1000=M or C$\overline{\text{I}}\supset$
7 =VII	2000=MM
8 =VIII	5000=I$\supset\supset$ or $\overline{\text{V}}$
9 =IX	$\overline{\text{6000}}$=$\overline{\text{VI}}$
10=X	10000=X or CC$\overline{\text{I}}\supset\supset$
11=XI	50000=I$\supset\supset\supset$
20=XX	$\overline{\text{60000}}$=$\overline{\text{LX}}$
30=XXX	100000=$\overline{\text{C}}$ or CCC$\overline{\text{I}}\supset\supset\supset$
40=XL	$\overline{\text{1000000}}$=$\overline{\text{M}}$ or CCCC$\overline{\text{I}}\supset\supset\supset\supset$
50=L	$\overline{\text{2000000}}$=$\overline{\text{MM}}$
60=LX	&c.

Addition

ADDITION.

ADDITION teacheth us to find
The truth of Numbers when combin'd;
The Sum or Total to expreſs
Of any Numbers, great or leſs.

Firſt of Simple Numbers.

RULE.

As Numeration does direct
To place your Numbers, don't neglect;
Firſt to the right begin to count,
And you will find with eaſe th' amount.
Then underneath write down th' exceſs
Above what Tens it ſhall expreſs;
Which Tens add up with the next row
And through the whole you thus muſt go.

Let theſe Numbers be added together.

EXAMPLE 1.	EXAMPLE 2.	EXAMPLE 3.
1473	654134	890147
6541	16475	86941
743	3589	7416
89	467	54
52	65	145
14	7	36789
8912	674737	1021492

To

To add up the Sum of EXAMPLE 1. Begin and ſay 4 and 2 are 6 and 9 is 15, then make a dot with the pen, and carry the overplus or exceſs to the next Figure, and ſay 5 and 3 are 8 and 1 is 9 and 3 is 12, make a dot, and write the exceſs above 10 in the place of Units, under the firſt line, and carry the two dots or tens to the ſecond row, and ſay 2 and 1 are 3 and 5 is 8, and 8 is 16 make a dot for the ten, and ſay 6 and 4 are 10, make a dot, and ſay 4 and 7 are 11, write down the overplus 1 under the ſecond line or row, and carry the three dots or tens to the third row and ſay 3 and 7 are 10 make a dot, then 5 and 4 make 9, which write under the third row, carrying 1 dot, or 10 to 6 makes 7 and 1 is 8, which write down under the fourth row, then the whole ſum of the Numbers given in Example 1 makes 8912; in words, eight Thouſand nine Hundred and twelve.

Some Arithmeticians who have made a little progreſs in Numbers, perhaps may object to the above method of pricking off the tens &c. and explode it, but Mr. EMERSON and the moſt celebrated Authors recommend it as a very ſure method for beginners, whether in Simple or Compound Numbers.

When the learner has got a little knowledge of what he is about, 'twill be found very eaſy to proceed in the following manner as by Example 2. Say 7 and 5 are 12, and 7 is 19 and 9 is 28 and 5 is 33 and 4 is 37 now there being 7 above 3 tens, write down the exceſs in the place of Units, and carry 3 to the ſecond row ſaying 3 and 6 are 9. and 6 is 15 and 8 is 23 and 7 is 30 and 3 is 33 write down 3 under the ſecond row and carry 3 to the third row, ſaying 3 and 4 are 7 and 5 is 12 and 4 is 16 and 1 is 17, write down 7 and carry 1 to the fourth row, then ſay 1 and 3 are 4, and 6 is 10 and 4 makes 14. write down the exceſs and carry 1 to the fifth row, ſaying 1 and 1 are 2 and 5 is 7 write down 7 under this row, then 6 only re-

remaining in the ſixth row write that down in its proper place, Unit them up according to your Numeration Table, and they will be ſix Hundred, ſeventy-four Thouſand, ſeven Hundred and thirty-ſeven. By either of the above methods proceed to add up the other Example, and you will have the ſum as there underneath it is.

The beſt way to prove Addition is by beginning at the top and adding up all the Numbers downwards, the ſame as you did upwards; if both ſums agree the Work is undoubtedly right.

EXAMPLE 4.

967891
234567
891456
789012
345678
3228604

EXAMPLE 5.

1234567
8901234
5678901
2345678
9012345
4567890
31740615

EXAMPLE 6.

I was born in the Year 1730, when ſhall I be 64 Years of Age?

This is no more than to 1730
Add 64
And we have the Year required 1794

Ex.

EXAMPLE 7.

A Gentleman had in his Nurſery one Million of Oak, one Hundred Thouſand Aſh, and one Hundred Fruit Trees, and alſo fifty-nine Elm and Lime Trees; I demand how many Trees were growing in the Nurſery?

Oaks - -	1000000
Aſh - -	100000
Fruit - -	- 100
Elm &c	- - 59
Anſwer	1100159 Trees in all.

EXAMPLE 8.

In ſeventeen Hundred, ſixty and ſix,
A Lady was born whoſe age I would fix;
To be twenty Years I'd have her no more,
But join her in bands, at th' age of one ſcore,
Then tell me TYRO, what Year this will be,
'Twill pleaſe th' dear Charmer, no doubt and pleaſe (thee?

To	1766
Add	20
Anſwer	1786 the year required.

Ex.

Example 9.

A Tree being cut into four parts, each part being measured contained 20, 25, 30 and 37 Solid Feet. What was the content of the whole Tree?

Place the Numbers under each other, thus.

20
25
30
37

Answer 112 Solid feet.

Example 10.

A Gentleman being upon his Travels rode through six market Towns A, B, C, D, E, F, in one day, setting out of the Town A and lying in the Town F all Night, found the distance from A to B 17 miles, from B to C 10, from C to D 16, from D to E 7, and from E to F 8 miles. I demand the miles travelled by the Gentleman that day?

			Miles.
From A	to	B	17
B		C	10
C		D	16
D		E	7
E		F	8

Answer 58

Ex.

Example 11.

Cyrus King of Perſia dyed in the year of the World 3479; when *Cambyſes* ſucceeded, and reigned 8 Years; *Darius Hyſtaſpes* 36 Years; *Xerxes* 21 Years; *Artaxerxes Longimanus* 41 Years; *Darius Nothus* 19 Years; *Artaxerxes Mnemon* 46 Years; *Artaxerxes Ochus* 21 Years; *Arogus* 2 Years, and *Darius Cadomanus* 4 Years. Required the Year of the World when this laſt Monarch dyed?

To find the whole period of this Perſian Monarchy, write down the Year *Cyrus* dyed, and each ſucceeding reign under, which added together Anſwers the conditions required.

Cyrus dyed in the year of the World - -	3479	Years.
Cambyſes reigned - - -	8	
Darius Hyſtaſpes - -	36	
Xerxes - - - -	21	
Artaxerxes Longimanus -	41	
Darius Nothus - - -	19	
Artaxerxes Mnemon - -	46	
Artaxerxes Ochus - -	21	
Arogus - - - - - -	2	
Darius Cadomanus - -	4	
Anſwer	3677	

Example 12.

Decypher the following numerical Roman Characters, and find their ſum Viz. DLXXXI; CCIↃ ↃCCXLII; CCCCIↃↃↃ; DC; MCCXXX; MD XXIV; DCIX; CCCIↃↃↃ CCXC and DCCLIX.

From

From the Roman Notation write down the value thus. — 581

10242 By the help of the
1000000 Roman Characters
600 many curious and a-
1230 muſing Paradoxical
1524 queſtions have been
609 propoſed and An-
100290 ſwered.
759

Anſwer 1115835

AMUSING QUESTIONS &c.

A Paradoxical Question.

Into my Houſe, came neighbour *John*,
With three legs and a wooden one;
If one was taken from the Swain,
Juſt five ye wits would then remain.

Solution.

According to the Roman notation the number of legs are *IV.* = 4. then by taking away the *I* only the *V* remaining makes 5. which anſwers the conditions required.

An.

Another by Mr. *Samuel Hammond*, in Ladies Diary for 1760.

In only *one*, I'll prove there's *none*,
In *ſeven*, *five*, no more;
But (without tricks) there's *nine* in *ſix*,
Altho' in *five* but *four*.
What I've above, propos'd to prove,
Is literally true,
And hope next year, ye artiſts rare,
'Twill be reſolv'd by you.

Anſwer'd in the then next year's Diary, viz. 1761, by *T. Sadler*, thus

In *One* a *Cypher* Sir I ſee, *O*.
In *ſeVen*, *five* I muſt confeſs, *V*.
In *ſIX* there's *nine* all muſt agree, *IX*.
In *ſIVe* there's *four* nor more nor leſs. *IV*.

TABLES of the moſt common Coins Weights and Meaſures, uſed in *Great Britain*.

Firſt of *Engliſh Money*.

Farthings. f.	Pence. d.	Shillings. s.	Pounds l.
4	1		
48	12	1	
960	240	20	1

SCHOLIUM.

The foregoing Table and the ſucceeding ones are explained in the following Manner, the words at Top expreſs the Names of all the numbers below them, with the Character under each Word, and are to be read, or learned by Heart thus; 4 farthings equal to 1 penny. 48 farthings 12 pence or 1 ſhilling. 960 farthings, 240 pence, 20 ſhillings equal to 1 pound. $\frac{1}{4}$ denotes 1 farthing, or 1 fourth of a penny, $\frac{1}{2}$ denotes 2 farthings, or 1 half of a penny; $\frac{3}{4}$ denotes 3 farthings, or 3 fourths of a penny. 4 pence is 1 groat, 6 pence 1 teſter, 5 ſhillings 1 crown, 6 ſhillings and 8 pence 1 noble, 10 ſhillings one angel, 13 ſhillings and 4 pence 1 mark.

TROY WEIGHT.

Grains. gr.	Pennyweights. dw.		
24	1	Ounces. oz.	
480	20	1	Pound. lb.
5760	240	12	1

The celebrated Mr. *Malcolm*, in his laborious Syſtem of Arithmetic page 74, ſays "That the Original of all Weights in *England* was a Corn of "Wheat, taken out of the middle of the Ear and "well dried; of which 32 made one Penny Weight, "inſtead of which, they made afterwards another "Diviſion of the Pennyweight into 24 Grains."

Mr.

Mr. *Ward* (in his Young Mathematicians Guide) cites a Statute of *Edward* III. by which there ought to be no Weight uſed but Troy, " but Cuſtom" (ſays he) " afterwards prevailed in giving larger Weight " to coarſe and Droſſy Commodities, and thereby " introduced the Weight called Averdupoiſe," and as to the proportion betwixt Troy and Averdupoiſe Weight, he ſays, " that by a very nice Experiment " he found that one pound Averdupoiſe, is equal to " 14 Ounces 11 Penny Weights 15 ½ Grains Troy " So that neither the Ounce nor Pound are the ſame.

By *Troy Weight* are weighed Jewels, Gold, Silver, Corn, Bread and Liquors.

APOTHECARIES WEIGHT.

Grains. gr.	Scruples. ſcr.	Drams. dr.	Ounces. oz.	Pounds. lb.
20	1			
60	3	1		
480	24	8	1	
5760	288	96	12	1

Apothecaries is the ſame as *Troy Weight*, and is ſo called becauſe the *Apothecaries Druggiſts* &c. compound their Medicines by it, but they buy and ſell their Drugs by *Averdupoiſe Weight*.

AVER-

AVERDUPOISE WEIGHT.

Grocery and chandlers wares, and all metals, except *gold* and *silver*, are weighed by this weight, according to Mr. *Malcolm*, sheeps wool weight has these denominations, 7 pounds = 1 clove, 2 cloves = 1 stone = 14 pounds, (but in *Scotland* and many places in *England*, 16 pounds are reckoned to the stone,) 2 stones = 1 tod, 6½ tods = 1 wey, 2 weys = 1 sack; 12 sacks = 1 last.

LONG

LONG MEASURE.

hes. n.	Feet. F.	Yards. Yd.	Poles. Pls.	Furlongs. F.	Miles. M.
12	1				
36	3	1			
98	16½	5½	1		
20	660	220	40	1	
60	5280	1760	320	8	1

In Long Measure, (according to the ſtatutes of 33 *Edward* I. and 25 *Elizabeth*,) a barley corn is the leaſt meaſure, whereof 3 taken out of the middle of an ear of corn, and well dried are 1 inch, 4 inches = 1 hand, 6 feet = 1 fathom, 3 miles = 1 league, 60 nautical or geographical miles 1 degree, or according to Mr *Norwood's* meaſure, 69½ miles make 1 degree; 360 degrees, or 25000 miles nearly, is the circumference of the earth.

CLOTH MEASURE.

Inches. In.	Nails. Na.	Quarters. Qr.	Yards. Yd.
$2\frac{1}{4}$	1		
9	4	1	
36	16	4	1

1 Ell { Flemiſh 3 qrs. / Engliſh 5 / French 6 / Scotch $4\frac{1}{2}$ inch.

SQUARE

SQUARE or LAND MEASURE.

Square Inch. Sq. In.	Sqr. Feet. Sq. Ft.	Sqr. Yds. Sq. Ys.	Sqr. Poles Sq. Pls.	Roods. Rds.	Acres. Acr.
144	1				
1296	9	1			
39204	$272\frac{1}{4}$	$30\frac{1}{4}$	1		
1568160	10890	1210	40	1	
6272640	43560	4840	160	4	1

10 chains *(per Gunter)* in length, and 1 in breadth, are an acre of land = 4840 yards.

WINE

WINE MEASURE.

Pints. pts.	Gallons. gal.	Tierces. tier.	Hhds. hd.	Punch. pu.	Pipe or Butt. pipe.	Tun. t.
8	1					
336	42	1				
504	63	1½	1			
672	84	2	1⅓	1		
1008	126	3	2	1½	1	
2016	252	6	4	3	2	1

Wines, brandies, ſpirits. perry, cyder, mead, vinegar, oil and honey, are meaſured by this meaſure. A gallon = 231 ſolid inches, an anchor = 10 gallons, a rundlet = 18 gallons, a barrel = 31½ gallons. Mr. *Ward* was witneſs to an experiment tried at *Guild-Hall* before the *Lord Mayor* &c. when the old ſtandard wine gallon was found to contain exactly but 224 cubical inches, yet for all that the ſuppoſed content of 231 inches are continued.

ALE AND BEER MEASURE.

Pints. pts.	Gallons. gal.	Firkins. fir.	Kilderkin. kild.	Barrels. bar.	Hhds. hds.
8	1				
68	8½	1			
136	17	2	1		
272	34	4	2	1	
408	51	6	3	1½	1

1 ale gallon = 282 cubic inches. The ale firkin in *London* contains 8 gallons, and the beer firkin 9. But in other places in *England* it is (by a ſtatute of exciſe made in the year 1689) 8½ gallons to the firkin.

DRY MEASURE.

Pints. pts.	Gall. gall.	Pecks. pks.	Bushels. bu.	Combs. cbs.	Quar. qr.	Weys. w.	Last. l.
8	1						
16	2	1					
64	8	4	1				
256	32	16	4	1			
512	64	32	8	2	1		
2560	320	160	40	10	5	1	
5120	640	320	80	20	10	2	1

A gallon dry measure contains 268$\frac{4}{5}$ cubic inches at *London*, 36 bushels of coals make a chaldron. A bushel water measure is 5 pecks. All dry wares such as corn, seeds, fruits, roots, sand, salt, coals, oisters, muscles, cockles, &c. are measured by this measure.

TIME.

Minutes. min	Hours. ho.			
00	1	Days. dv.		
1440	24	1	Weeks. wk.	
10080	168	7	1	Months. mo.
40320	672	28	4	1

OF MOTION.

‴ ″ ′ ° ˢ

Mark'd thus T. S. M. D. S.

60 Thirds make 1 second″,
60 Seconds 1 minute′,
60 Minutes 1 degree°,
30 Degrees 1 sign of the zodiac.

COM-

COMPOUND ADDITION.

To add up numbers of ſeveral denominations together, obſerve the following

R U L E.

Let all your numbers placed be,
In form and order to agree;
Pounds under pounds, the reſt ſo name,
Of weights and meaſures do the ſame.

Before we proceed to work any examples, it will be neceſſary to get by heart the following

P E N C E T A B L E S.

d.		*s.* *d.*	*s.*		*d.*
20		1 – 8	2		24
30		2 – 6	3		36
40		3 – 4	4		48
50		4 – 2	5		60
60		5 – 0	6		72
70	are	5 – 10	7	are	84
80		6 – 8	8		96
90		7 – 6	9		108
100		8 – 4	10		120
110		9 – 2	11		132
120		10 – 0	12		144

Add theſe Sums of Money together.

EXAMPLE 1.

£.	s. (20)	d. (12) (4)
1	16.	4.
12	10	9 ¼.
341	16.	4.
9.	10.	11. ¾
18.	15	8
384	10	1

EXAMPLE 2.

£.	s.	d.
41	14	5 ¾
86	18	11 ¼
51	19	4 ½
67	17	7 ¾
12	12	3 ¼
261	2	8 ½

To add up Example 1. Begin and ſay 3 and 1 is * 4, make a dot and carry 1 to the next denomination, ſaying, 1 and 8 is 9 and 11 is 20, make a dot and carry the overplus above 12, to wit 8, to the next figure, ſaying, 8 and 4 is 12, make a dot and ſay, 9 and 4 is 13, which is 1 above 12, therefore make a dot and write down 1, and carry the three pricks or dots to the next denomination, and ſay, 3 and 15 is 18, and 10 is 28, make a dot and carry the exceſs above 20, to wit, 8 to the next figure, ſaying 8 and 16 is 24, make a dot, then ſay 4 and 10 is 14, and 16 is 30, make a dot, and write down the exceſs 10 under its own line, and carry 3 (the number of dots) to the place of pounds, and ſay, 3 and 8 is 11, make a dot, and ſay, 1 and 9 is 10, make a dot, then 1 and 2 is 3 and 1 is 4, which write under its own line, and carry the 10 or dots to the next row. Saying, 2 and 1 is 3 and 4 is 7 and 1 is 8, write down 8 at the bottom of the line, then 3 remains in the

* See the marginal notes in Multiplication.

third row, which write down in the third place, and the ſum total is, three hundred and eighty four pounds, ten ſhillings and one penny.

The above method being ſo eaſy to be underſtood, I ſhall now proceed to ſhew the learner how to add up ſuch ſums by a more expeditious method, and for that purpoſe, take Example 2. and ſay, 1 and 3 is 4, and 2 is 6 and 1 is 7 and 3 make 10; 10 farthings is two pence halfpenny, ſet down the halfpenny thus ½ and carry the two pence to the pence row, ſaying, 2 and 3 is 5, and 7 is 12 and 4 is 16 and 11 is 27 and 5 is 32, then ſay, 30 pence is 2 ſhillings and 6 pence, and 2 pence is 2 ſhillings and 8 pence, ſet down 8 and carry 2; and proceed to the ſhillings and ſay, 2 and 2 is 4, and 7 is 11, and 9 is 20 and 8 is 28 and 4 is 32 (which is 2 above 3 tens) ſet down the 2 and go on to the next row (which is compoſed of a number of *ones* being ſo many *ten ſhillings*, as you may ſee by their being placed or ſet in the *place of tens*) and (therefore) carry the 3 tens thereto, and ſay, 3 and 1 is 4 and 1 is 5 and 1 is 6 and 1 is 7 and 1 is 8, eight ten ſhillings make 4 pounds, which carry to the place of pounds, and ſay, 4 and 2 is 6 and 7 is 13 and 1 is 14 and 6 is 20 and 1 is 21, write down 1, and carry 2 ſaying, 2 and 1 is 3 and 6 is 9, and 5 is 14, and 8 is 22 and 4 is 26, which write down and the total will be two hundred and ſixty one pounds, two ſhillings and eight pence halfpenny, in the ſame manner proceed with the following examples, or any other of the like kind or ſort.

EXAMPLE 3.

£.	s.	d.
941	12	1 ¾
345	16	5 ¾
678	19	4 ¼
900	14	5 ½
571	13	3 ¼
3438	15	8

EXAMPLE 4.

£.	s.	d.
12345	14	¼
1234	16	1 ¾
123	-	3 ¼
12	14	-
1	13	11 ¾
13717	18	5

EXAMPLE 5.

£.	s.	d.
51	14	5 ¼
65	13	9 ¾
78	18	8 ½
90	10	5 ¾
12	14	10 ¼
34	13	3 ¾
12	12	2 ½
346	17	9 ½

EXAMPLE 6.

	£.	s.	d.
Received of Mr. *East*	41	11	-
Mr. *West*	9	16	4
Mr. *North*	6	17	9 ½
Mr. *South*	8	11	2
Receiv'd in all	£.66	16	3 ½

EXAMPLE 7.

A Tradesman received in cash of *A.* 4l. 1s. 4d. of *B.* 13l. 14s. 5d. ½ of *C.* 81l. 16s. 8d. of *D.* 94l. 10s. 9d. ½ of *E.* 5l. 16. 8d. and of F. 51l. os. 8d. ¾ What was the sum receiv'd?

	£	s.	d.
Received of *A.*	4	1	4
B.	13	14	5 ½
C.	81	16	8
D.	94	10	9 ½
E.	5	16	8
F.	51	-	8 ¾
Receiv'd in all	£.251	-	7 ¾

EXAMPLE 8.

Zebedee owes his brother *Ambroſe* fourteen ſhillings and nine pence halfpenny, his brother *Thomas* twenty five ſhillings and four pence, his brother *Joſeph* ſixteen ſhillings and three farthings, his ſiſter *Mary* one pound ſeven groats, and two-pence, and to his neighbour *Owen*, a noble. How much does he owe in all?

		l.	*s.*	*d.*
Due to	*Ambroſe*		14	9 ½
	Thomas	1	5	4
	Joſeph		16	¾
	Mary	1	2	6
	Owen		6	8
Anſwer		*l.* 4	5	4 ¼

EXAMPLE 9.

Old SIMON aged ninety two,
At laſt did bid this world adieu,
Some mouldy pelf he left behind,
Which oft diſturb'd his craving mind.
Four ſons he had, and each now claims
His ſhare, *John*, *Simon*, *Ralph*, and *James*;
His wife b'ing dead, he'd daughters three,
Call'd *Suſan*, *Ruth*, and *Margery*.
His will b'ing read, *young Simon* found,
He muſt receive *three hundred pound*,
Juſt *eight ſcore pounds* too was *Ralph's* part,
But *John* he bore an aching heart,
And of his fortune was beguil'd,
Becauſe he'd got their maid with child.

One

One ſhilling only was his ſhare,
But *James* it ſeems had better fare,
Of caſh in *pounds ſix ſcore* had he,
And *Suſan's* part was *ninety three*;
But *Ruth* unlucky girl had ran
Away with *Joe* the ſervant man,
And for the haſty crime ſhe'd done,
Was cut off juſt the ſame as *John*;
But *Marg'ry's* ſhare amongſt the reſt,
By calculation prov'd the beſt,
For by the father's will we find,
The cheſt which SIMON left behind
Had ſtore of pelf,—the treaſure found,
Amounted to *four hundred pound*:
Of clothes and goods it did appear,
Juſt *thirty pound* was made out clear,
All this was left to *Madge* becauſe,
She had obey'd her father's laws.
Now Tyro you with eaſe may find,
The fortune SIMON left behind.

To anſwer this Example, is no more than to write down each one's fortune as under, and add them together.

		l.	*s.*	*d.*
Simon's	ſhare	300	—	—
Ralph's		160	—	—
John's		—	1	—
James's		120	—	—
Suſan's		93	—	—
Ruth's		—	1	—
Marg'ry's		430	—	—
Sum left		*l.* 1103	2	—

EXAMPLE 10.

A houſe keeper had diſburs'd for her lady, in marketting, (per memorandum book,) for *beef*, ten ſhillings and five pence halfpenny, *mutton*, ſeven ſhillings and eight pence, *veal*, five ſhillings and three pence farthing, *chickens*, nine groats, and for *eggs*, ſeven farthings. What was the ſum diſburſt?

	s.	d.
Beef - -	10	5 ½
Mutton - -	7	8
Veal - -	5	3 ¼
Chickens - -	3	—
Eggs - -		1 ¾
Sum £.	1	6 6 ½

EXAMPLE 11.

Frank Guzzle, *Bekch*, and *Soaking Dan*,
Muſt have a bottle with Sir *John*, *
And topers like with TROT † prevail,
To fill a jug of nappy ale.
A jug! a mighty jug indeed,
A yard about was fill'd with ſpeed;
Ten quarts it held, as neighbours tell,
Which pleas'd the *Landlord* mighty well.
Three times b'ing fill'd the topers they,
Cou'd ſcarce conduct themſelves away,
But paid the ſcore which pleaſed TROT,
To think what cuſtomers he'd got,
'Twas *fifty pence* a piece the ſhot,
What was the whole young Tyro tell;
Which pleas'd the *Landlord* TROT ſo well?

By

* *Sir John Barleycorn* † *The Landlord.*

By pence *Table* 50 pence is 4*s.* - 2*d.* which write down three times thus.

	l.	*s.*	*d.*
Frank Guzzle - -	–	4	2
Belch - -	–	4	2
Soaking Dan - -	–	4	2
The ſum ſpent	–	12	6

EXAMPLE 12.

A Farmer's bill, upon his Labourer.

Roger Furber,

1770. To *John Simon.* *Dr.*

		l.	*s.*	*d.*
May 30:	To a meaſure of Corn	–	5	8
June 8:	Ditto -	–	6	3
24:	Ditto -	–	7	–
30:	A buſhel of Oats	–	2	6
July 1:	A load of Coals	–	16	–
12:	Beef - -	–	4	4
18:	Butter -	–	1	6½
	Total	*l.* 2	3	3½

An

EXAMPLE 13.

An Aſſeſſment for the Highway Levy or Ley, in the Townſhip of N—— and Pariſh of M——— in the County of *Cheſter*, rated at 3*d* per pound, from *Michaelmas* 1769, to *Michaelmas* 1770.

	l.	*s.*	*d.*
Sir *Ambroſe Longbutts*, Bart.	2	4	8½
Sampſon Gripe Eſq. —	1	3	11
Iſaac Tarrat — —	1	7	9½
Samuel Bentley —	2	1	1
William Swift —	1	8	4
James Brown —	2	3	1½
Charles Hutton —	3	—	4½
Tereſa Phillips —	1	10	5
Anne Nicholls —	2	15	11½
Benjamin Weſt —	2	1	—
Thomas Baker —	1	4	11
Patrick O'Cavannah —	1	15	10½
Arthur Burns —	2	3	7
Edward Hamnet —	1	4	1½
William Breeze —	1	14	9
Thomas Weaver —	—	18	10½
Samuel Hodgkin —	—	16	11
Thomas Holland —	—	4	5½
William Gough —	2	3	4
Robert Langley —	3	14	11½
	l. 35	18	6

EXAM-

Example 14.

A *Gentleman* gave orders to an *Auctioneer*, to ſell him the following farms or tenements. What is the ſum total of their yearly rent?

Tenants Names	*Rent per Ann.*		
	£.	*s.*	*d.*
Jeffery Blake	27	5	–
Thomas Jenkin	15	15	–
John Fiſher	12	12	–
Ambroſe Sadler	40	–	–
Zebedee Sadler	7	10	–
Thomas Sadler	5	10	–
Joſeph Sadler	4	10	–
Stephen Gibbons	3	15	–
William Podmore	1	16	6
Ralph Ireton	1	10	–
Job Bate	1	17	–
Guy Cobb	1	18	6
John Knowles	1	1	–
Anſwer	*£.* 125	–	–

Troy Weight.

A *Lady* of fortune being desirous of furnishing herself with houshold plate, went to a Silver-smith and bought *dishes* to the weight of 20 lb. 10 oz. 18 dwt. and 21 grs. *plates* 37 lb. 19 dwt. and 14 gr. *spoons* 8 lb. 9 oz. and 4 dwt. *salts* 3 lb. 15 dwt. and 19 gr. a *tankard* and *cup* 5 lb. 11 oz. and 14 dwt. and also three *waiters* 12 lb. and 23 gr. What weight of plate did she buy in all?

Write down the weight of each quantity under each other, and add them up as in addition of Money, only take care to point or dot, according to the table pertaining to this weight in page 14 and as you see express'd at the top of each denomination in this example.

	(12) lb.	(20) oz.	(24) dwt.	gr.
Dishes -	20	10	18	21.
Plates -	37	-	19	14.
Spoons -	8	9	4	-
Salts -	3	-	15	19.
Tankard &c.	5	11	14	-
Waiters -	12	-	-	23
	87	9	13	5

Note, you may work this example and all others of the kind without dotting, (except at the grains) for the *penny weights* are to be work'd the same as *shillings*, the *ounces* as *pence*, and the *pounds* as *integers*.

Apo-

Apothecaries Weight.

An *Apothecary* made a compoſition of 6 ingredients, the weight of the 1ſt. was 12 lb. 6 oz. 4 dr. 1 ſcr. and 13 gr. the 2d. 8 lb. 4 oz. 5 dr. 2 ſcr. and 14 gr. the 3d. 9 lb. 1 ſcr. and 16 gr. the 4th. 14 lb. 3 oz. and 1 dr. the 5th. 6 lb. 11 oz. 4 dr. 2 ſcr. and 17 gr. and the 6th. 11 lb. 2 ſcr. 5 gr. What was the weight of the whole?

No.	lb.	(12) oz.	(8) dr.	(3) ſcr.	(20) gr.
1	12	6	4.	1	13
2	8	4	5	2.	14
3	9	-	-	1	16
4	14	3	1.	-	-
5	6	11	4	2.	17
6	11	-	-	2.	5
Anſ.	62	2	1	2	5

Note, the *grains* are caſt up as ſhillings, and the *ounces* as pence.

Averdupoize Weight.

A Country ſhopkeeper bought of a Tradeſman in *London*, *Sugars* weighing 4 c. 3 qrs. and 9 lb. *Raiſins* 2 c. 1 qr. and 21 lb. *Teas* 1 c. and 3 qrs. *Coffee* 3 qr. and 19 lb. and *Spices* 1 c. and 12 lb. What was the whole weight?

	c.	(4) qr.	(28) lb.
Sugars -	4	3	9.
Raiſins -	2	1	21
Teas -	1	3	-
Coffee -	-	3	19.
Spices -	1	-	12
Anſwer	11	-	5

N. B. No occaſion for dotting at the *quarters*, they being caſt up as tho' they were farthings.

A Stocking Weaver bought 6 bales of silk containing, (*viz.*)

N°.	lb.	(16) oz.	(16) dr.
1	5	10.	12.
2	2	8	14.
3	3	4	15.
4	6	14.	12.
5	5	15.	8
6	1	2	3
Answer	25	9	–

Long Measure.

A Turnpike Surveyor measures upon the road, from *A* to *B* 6 miles, 4 furlongs 15 poles, from *B* to *C* 4 miles, 7 furlongs, 30 poles, from *C* to *D* 10 miles, 20 poles, from *D* to *E* 9 miles, 6 furlongs, 12 poles, and from *E* to *F* 12 miles 2 furlongs 15 poles. What is the distance betwixt *A* and *F*?

			(8) m.	(40) fur.	pls.
From *A*	to	*B*	6	4	15.
B		*C*	4	7.	30
C		*D*	10	–	20.
D		*E*	9	6.	12
E		*F*	12	2	15
Answer			43	5	12

Note, there is no need to dot when adding up *poles*, for they are only as tho' they were two rows of figures the first *integers*, and the second *farthings*, but that I may not leave the learner under the least difficulty (of which I shall always be as careful as possible) let me further explain my meaning, by shewing how to add

The diſtance from 4 ſtatues, *A B C D* being meaſured along a walk to an obeliſk in a nobleman's garden, was found to be as follows to wit, from *A* to *B* 140 yards, 2 feet, 11 inches. *B* to *C* 134 yards, 1 foot, 9 inches. *C* to *D* 151 yards, 4 inches. and from *D* to the obeliſk 108 yards, 2 feet, 8 inches. What was the whole diſtance?

				(3) yds.	(12) ft.	inch.
From	*A*	to	*B*	140	2.	11
	B		*C*	134	1	9
	C		*D*	151	–	4
	D		ob.	108	2.	8
Anſwer				535	1	8

Note, *inches* are caſt up in the ſame manner as *pence*.

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add up the *poles* in this example, to do which, ſay 5 and 2 is 7 and 5 is 12, ſet down 2 and carry 1, and ſay, 1 and 1 is 2 and 1 is 3 and 2 is 5 and 3 is 8 and 1 is 9; 9 *quarter poles* is 2 *furlongs* and 1 quarter, the ſame as 9 farthings is 2 pence farthing, therefore ſet down 1, and the ſum is 2 furlongs and 12 poles, the ſame as if you had dotted, then carry the 2 furlongs to the row of furlongs, and proceed to work the queſtion.

Cloth Measure.

A *draper* at a Fair bought 5 pieces of cloth, each piece containing as follows, viz.

N°.	yds.	(4) qr.	(4) nls.
1 ——	35	3	3
2 ——	46	1	2
3 ——	21	3	1
4 ——	47	1	3
5 ——	19	2	1
Anſwer	171	-	2

The learner may obſerve that *nails* and *quarters* are caſt up the ſame as *farthings*.

Land Measure.

A *farmer* rents 4 pieces of land containing.

	ac.	(4) ro.	(40) pls.
In one field	16	1	24
In another	24	3	14
In another	21	1	12
In another	13	1	34
Anſwer	75	3	34

To caſt up *poles* without dotting you have directions in the preceding page, and the *roods* are added up as though they were *farthings*.

Wine

Wine Measure.

A *nobleman* bought of a *wine merchant*, the following ſorts and quantities of wine *viz. port* 1 tun 1 hogſhead and 36 gallons, *claret* 2 hogſheads 49 gallons, *mountain* 2 hogſheads 30 gallons and 4 pints, and *liſbon* 3 hogſheads 7 pints. How much did he buy in all?

	(4) tu.	(63) hhd.	(8) gal.	pts.
Port	1	1	36	–
Claret	–	2	49.	–
Mountain	–	2	30	4.
Liſbon	–	3	–	7
Anſwer	3	1	53	3

Hogſheads are caſt up the ſame as *farthings*.

Ale *and* Beer Measure.

A *London brewer* ſent into the country, ale and beer as follows, viz. at one time 4 hogſheads 19 gallons, at another 3 hogſheads 15 gallons, at another 12 hogſheads 24 gallons, at another 5 hogſheads 19 gallons, and at another 8 hogſheads 5 gallons. How much was ſent out in all?

		(51) hhds.	gal.
Delivered the 1ſt. time		4	19
2d. time		3	15.
3d. time		12	24
4th. time		5	19
5th. time		8	5
Anſwer		33	31

Dry Measure.

A *cornfactor* delivers out of his granary the following quantities of corn, *to wit*, *wheat* 7 quarters 1 comb 3 buſhels and 2 pecks, *rye* 5 quarters 1 comb 2 buſhels and 1 peck, *oats* 4 quarters 1 buſhel and 3 pecks, and *barley* 3 quarters 1 comb and 3 buſhels. What was deliver'd in all?

	(2) qr.	(4) com.	(4) bu.	pks.
Wheat	7	1	3	2
Rye	5	1	2	1
Oats	4	–	1	3
Barley	3	1	3	–
Anſwer	21	1	2	2

The *pecks* and *buſhels* are caſt up like *farthings*, and the *combs* like halfpence.

Time.

A certain perſon had 4 ſons, *Ralph*, *John*, *James*, and *Andrew*, when *John* was born, *Ralph's* age was 2 years 4 months 1 week and 3 days, when *James* was born, *John's* was 3 years 5 months 3 weeks and 4 days, and when *Andrew* was born *James's* age was 4 years 9 months 1 week and 5 days. How old was *Ralph* (the eldeſt ſon) when *Andrew* (the youngeſt) was born?

(12)(4)(7)
y.m.w.d.

Ralph's, *John's*, *James's* } age when { *John*, *James*, *Andrew* } was born { 2 4 1 3 / 3 5 3 4 / 4 9 1 5

Anſwer 10 7 2 5

Here you ſee that *weeks* are to be added up in the ſame manner as *farthings*, and *months* in the ſame manner as *pence*.

Pro-

PROMISCUOUS QUESTIONS,

Selected from the beſt authors, for the exerciſe of the learner, with the *name* of the *author* prefixed to his performance.

Queſtion 1. From Mr. *Vyſe's* Arithmetic, *page* 30.

A perſon ſaid he had 20 children, and that it happen'd there was a year and a half between each of their ages, his eldeſt was born when he was 24 years old, and the age of the youngeſt is now 21. What was the father's age?

	years
Father's age when the eldeſt child was born	24
19 Children allowing 1 year $\frac{1}{2}$ between each	$28\frac{1}{2}$
The age of the youngeſt child	21
The age of the father	$73\frac{1}{2}$

Queſtion 2. By the celebated Mr. *Emerſon*;* ſee his Arithmetic *page* 189.

Three companies of ſoldiers paſſing by a ſhepherd the firſt takes half his flock and half a ſheep, the ſe-

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Note, when the learner is thoroughly acquainted with the rule of *Reduction*, it will then *plainly* appear to him, that there will be no need to point or dot in caſting up any ſum in addition of what kind ſoever, and which will be far preferable than dotting, as no dots or blots ought to be made (if poſſible to be avoided) amongſt writing or figures.

* Mr. *Emerſon* ſolves this queſtion by *double poſition*.

cond takes half the remainder and half a ſheep, the third takes half the laſt remainder and half a ſheep, after which the ſhepherd had 20 remaining. How many had he at firſt? It is evident by the queſtion the ſhepherd had taken from him at the 3 different times 21, 42, and 84, to which add 20 remaining the ſum will be 167 the anſwer required.

A Paradoxical Queſtion extracted from the *Royal Magazine.*

A gentleman dying left his executor a ſum not amounting to 2000l. to be ſo divided amongſt his relations, that his *father* and *mother* his *ſon* and his *grandſon*, his *brother* and his *daughter*, ſhould each receive a ſum not leſs than 666l. 13s. 3d. *Quere* the ſcheme of kindred and exact ſum left?

SOLUTION.

Suppoſe two widows *A* and *B* no kin to each other, to be left each with a ſon, and that *A's* ſon marries *B*, and *B's* ſon marries *A*, and that *A's* ſon has a ſon by *B*, this is the ſcheme of kindred. *Note*, *A's* ſon is the gentleman that leaves the money, and for finding the exact ſum left, proceed thus

	l.	*s.*	*d.*
To his *father* who in this caſe is the ſame as his *ſon*.	666	13	3
To his *mother* who in the ſame manner is his *daughter*.	666	13	3
To his *grandſon* likewiſe who is the ſame as his *brother*.	666	13	3
Sum left	1999	19	9

The

The learner now being ſuppoſed to be ſufficiently taught to add up any ſum of pounds, ſhillings, pence, &c. 'twill be neceſſary and much to his or her advantage, to get by heart the following forms of *acquittances*, *promiſſory notes* &c. and to tranſcribe them into his or her accompt book, in order to prepare themſelves for real buſineſs. As to forms of bills of parcels &c. they will be found inſerted after the rule of *practice*.

Acquittances upon Receipt of Money.

Auguſt 4th, 1772.

Received of Mr. *Anthony Champion* the ſum of ten pounds fourteen ſhillings and nine pence in full of all demands

per *Timothy Sly*.

£10 14 9

Received 12th, *Auguſt* 1772 of Mr. *Iſaac Pedley* forty pounds on account.

per *Matthew Prior*.

£40

Reced *May* 2d, 1772 of Mr. *Patrick Mc Quinſey*, eighteen pounds and eighteen ſhillings, being his year's rent for 1771, for late *Bentley's* houſe &c. due *Lady Day* laſt (1772)

£.	s.	d.
18	18	0

To me *William Peers*.

Reced 10th, *April* 1772 of Mr. *Silas Hopley*, fifteen pounds and fifteen ſhillings on account of goods ſold him

£.	s.	d.
15	15	0

By me *Andrew Marvell*.

Ralph

Ralph Stanley Esq. To *James Jones* Esq. Dr.

To taxes paid for the Woodland Tenement in B— for the year 1771, as under

	£. s. d.	£. s. d.
Land tax at 4s. per pound		2 15 0
1st poors ley	0 13 9	
2d. do.	0 10 3 ¾	1 10 11 ¾
3d. do	0 6 10 ½	
Highway do. (not any)		
Constables do.		0 6 10 ½
Church do.		0 3 5 ¼
		£.4 16 3 ¾

Reced *April* 14th, 1772 of *Ralph Stanley* Esq. (by the hands and payment of his agent Mr. *Peter Proud*) the contents of this bill for the use of *James Jones* Esq. by me *John Toxley*.

Reced *April* 14th, 1772 of Captain *James Jones* (by the hands and payment of his agent Mr. *John Toxley*)

		£. s. d.
In cash - - - -	£22 13 9	
per bill of taxes paid for the year 1771*	£. 4 16 3	
in the whole twenty seven pounds and ten shillings, being his last half year's rent for 1771, for the Woodland Tenement in B— due *Lady Day* last (1772) to *Ralph Stanley* Esq. for whose use the same is received		£. 27 10 0

by me *Peter Proud*.

Reced 19th, *April* 1772 of Mr. *Ralph Jameson* (per son *George*) forty pounds being his first half year's rent for 1768, for late *Jackson's* tenement due to *Ralph Stanley* Esq at *Michaelmas* 1768,

£.	s.	d.
40	0	0

per *Peter Proud*.

* See the bill of taxes above.

Reced.

Reced. *April* 20th, 1772 of Mr. *Simon Tradewell*, nineteen pounds and ten ſhillings, in full for my maſter *Peter Dealer*,

By me *Robert Jacobs*.

£19 10 0

Rece'd *April* 24th, 1772 of the Right Reverend *Abiathar* Lord Biſhop of C—— by the hands of Mr. *Francis Harding*, the ſum of one hundred and fifty pounds, in full for three quarterly payments of my annuity, due *Lady Day* laſt paſt (1772)

£.150 To me *Jamima Lovely*.

February 16th, 1772 reckoned and balanced all accompts, and I *Simon Rowley* do acknowledge my ſelf to be indebted to *Beardmore Duckenfield*, five pounds four ſhillings, which I promiſe to pay to him or his order on demand, for value received as witneſs my hand,

Witneſs *Simon Rowley*.

Jacob Manlove.

Sir £5 4 0 *Whitchurch February* 18th, 1772

Pleaſe to pay to Mr. *Beardmore Duckenfield* or order, five pounds four ſhillings and place it to the account of

Your humble Servant

Simon Rowley.

To Mr. *Aaron Hill* Grocer at the three Sugar Loaves *Fleet-ſtreet London*.

London June 6th, 1772

I promiſe to pay the Honourable *Congreve Ellis* Eſq. or bearer, on demand, ſixty pounds.

For Sir *James Rich* and partners.

Thomas Trueman

£60

I promiſe

I promiſe to pay to Mr. *Luke Spiggot* or bearer on demand, forty pounds, *January* 19th, 1772.

per *James Jones.*

£40

I promiſe to pay to *Robert Heath* Eſq. or order on demand, ſixty-three pounds and ten ſhillings, value received this 24th day *March* 1772.

by me *Thomas Holland.*

£63 10

I promiſe to pay to Sir *Solomon Lowe* or order, the ſum of forty pounds in manner following, that is to ſay, twenty pounds, part thereof two months after date, ten pounds another part thereof, on the 16th, day of *December* next, and the remaining ten pounds on the 30th of *March* next (1773,) for value of him received as witneſs my hand at *Cheſter* the 15th day of *June* 1772. *Nathaniel Fiſher.*

£40

Signed in the preſence of
Simon Teſtis
Reuben Jones

SUBTRACTION.

SUBTRACTION is a uſeful art,
Whene'er you pay a ſum in part
To find the diff'rence left behind,
As by the rule below ſubjoin'd.

Of

Of Simple SUBTRACTION.

RULE.

From ev'ry greater ſum ſubtract
The leſſer and to be exact,
Begin to work with units row,
And write the diff'rence down below;
And when the upper figure's leſs
Than what that under ſhall expreſs,
Add ten,——ſubtract,——and carry one
To the next figure——thus go on.

To prove ſubtraction is no more than adding the difference to the next line above it, and if the ſum be the ſame as the top-line, then the operation is right.

EXAMPLE 1.

From	94165
Take	35641
Rem.	58524
Proof	94165

EXAMPLE 2.

From	861416
Take	596789
Rem.	264627
Proof	861416

EXAMPLE 3.

From	431678
Take	390169
Rem.	41509
Proof	431678

EXAMPLE 4.

From	900000
Take	345678
Rem.	554322
Proof	900000

To work example 1ſt, ſay 1 from 5 and there remains 4, write down the difference 4 in the place of units, and ſay, 4 from 6 and there remains 2, which write down in the place of tens. Then ſay 6 from 1 I cannot, but 10 that I borrow to 1 is 11, 6 from 11 and there remains 5, then 1 that I borrowed and 5 is 6, 6 from 4 I cannot, but 6 from 14 and there remains 8, 1 that I borrowed and 3 is 4, 4 from 9 and there remains 5. Then to prove if the work be right, ſay 4 and 1 is 5, 2 and 4 is 6, 5 and 6 is 11, ſet down 1 and carry 1 to 8 is 9, and 5 is 14, ſet down 4 and carry 1 and ſay 1 and 5 is 6, and 3 is 9, which ſet down, and you will ſee that this line correſponds with the uppermoſt, and proves the work to be right.

EXAMPLE 2.

To work this example you muſt ſay, 9 from 6 I cannot, but 9 from 16, and there remains 7, 1 that I borrowed to 8 is 9, 9 from 1 I cannot, but 9 from 11 and there remains 2, 1 that I borrow'd, to 7 is 8, 8 from 4 I cannot. but 8 from 14 and there remains 6, 1 that I borrow'd, to 6 is 7, 7 from 1 I cannot, but 7 from 11 and there remains 4, 1 that I borrow'd to 9 is 10, 10 from 6 I cannot, but 10 from 16 and there remains 6, 1 that I borrow'd to 5 is 6, 6 from 8 and there remains 2, which ſet down and the work is done, but as theſe things are ſo eaſy, I think that any further explanation of the reſt wou'd be look'd upon as prolixity only.

SCHOLIUM.

Subtraction is juſt the reverſe of *Addition*, for inſtead of adding a given number, to a given number; we take a leſſer given number from a greater. Many authors call the greater number the *Subtrahend*, and the leſſer the *Minuend*, and the one taken from the other is the *difference*.

EXAM-

EXAMPLE 5.

Roger Bacon a learned *Engliſh Monk*, of the Franciſcan order, was born near *Ilcheſter* in *Somerſetſhire*, in the year 1214. How many years is that ſince?

From 1772
Take 1214

Anſwer 558 years.

EXAMPLE 6.

The age of a lady is twenty and three,
What year was ſhe born in, pray tell unto me?

From 1772
Take 23

Anſwer 1749

EXAMPLE 7.

Rene des Cartes a moſt eminent *French* philoſopher and mathematician was born in 1596, and died in 1650. How old was he at the time of his death?

From 1650
Take 1596

Anſwer 54 years.

EXAMPLE 8.

Solon died 549 years before CHRIST was born, How many years was that after the creation of the world?

First, 549 + 1772 = 2321 the number of years ſince he died,

Then from 5779 } the number of { the creation.
Take 2321 } years ſince { *Solon* died.

Anſwer 3458

EXAMPLE 9.

Ovid a celebrated poet, and Roman knight, was born in the year of the world 3964. How many years is that ſince?

From 5779
Take 3964

Anſwer 1815 years.

EXAMPLE 10.

Since *Siſyphus* reigned, it plainly appears,
Is two thouſand ſev'n hundred, forty nine years,
Since *Seſac* was living who *Japetus* ſlew,
Is two thouſand ſeven hundred *plus* twenty two.
Since *Heſiod* flouriſh'd, chronology'll fix,
Two thouſand ſix hundred and thirty *plus* ſix.
Since *Tiglath-pileſer* ſucceeded king *Pul*,
Is two thouſand, five hundred thirteen years full.
Since *Nabopolaſſar*, old *Babylon* won,
Is two thouſand three hundred ninety *plus* one.
Betwixt each event the interval of time,
I'd have you make known e'er mount ſcience you climb.

Note

Note this queſtion I propos'd in the year 1766. —To anſwer which firſt,

From 2749
Take 2722

Anſw. 27 years from *Siſyphus* to *Seſac.*

2d. From 2722
Take 2636

Anſwer 86 years from *Seſac* to *Heſiod.*

3d. From 2636
Take 2513

Anſwer 123 years from *Heſiod* to *Tiglath-pileſer.*

4th. From 2513
Take 2391

Anſwer 122 years from *Tiglath-pileſer* to *Nabopolaſſer.*

EXAMPLE II.

The height of the *Monument* at *London* is 202 feet, which is 24 feet higher than the *Trajan's Pillar* at *Rome,* I demand the height of the pillar?

From 202
Take 24

Anſwer 178 feet.

EXAMPLE 12.

Two maypoles length, thirty-ſix yards not more,
Diff'rence in inches, fourteen tens *plus* four.
Th' diff'rence of yards, when added to their ſum,
Is twice the great pole, hence an anſwer 'll come.

SOLUTION.

Firſt, 144 inches are equal to 4 yards, then it is plain per queſtion, that 36 yards (the length of the 2 poles) added to 4 (to wit, their difference in yards) = 40 which (by queſtion) is twice the length of the greater pole, conſequently 20 is the real length thereof. in yards then,

From 20 the length of the greater pole.
Take 4 the difference

Rem. 16 the length of the leſſer pole.

EXAMPLE 13.

An old worthleſs miſer juſt before he expired made his will, wherein he directed that the ſum of 4000 l. (to wit, the amount of his eſtate) ſhou'd be divided between his wife and 4 daughters in manner following, viz. to the *eldeſt daughter* 1000l. *minus* 100l. to the *ſecond daughter* 1000l. *minus* 200l. to the *third daughter* 1000l. *minus* 300l. to the *fourth daughter* 1000l. *minus* 400l. and the remaining part to the widow. What had each one to their reſpective ſhare?

l.
From 1000
Take 100

Anſ. 900 eldeſt daughter's ſhare.

From

	£.
From	1000
Take	200
Rem.	800 second daughter's share.
From	1000
Take	300
Rem.	700 third daughter's share.
From	1000
Take	400
Rem.	600 youngest daughter's share.

		£.	£.
Whole Estate			4000
Eldest	Daughter's Share	900	
Second		800	
Third		700	
Youngest		600	
			3000
Remains widow's share			1000

EXAMPLE 14.

A nobleman had in his park 1000 oak, 6000 aſh, 4000 beech, 900 poplar, 1146 elm, and 180 fir trees. Out of which were fal'n, 424 oak, 2346 aſh, 310 beech, 149 poplar, 146 elm, and 80 fir trees. How many trees were left ſtanding in the ſaid park?

N°. of Trees.		N°. of Trees fallen.	
Oak	1000	Oak	424
Aſh	6000	Aſh	2346
Beech	4000	Beech	310
Poplar	900	Poplar	149
Elm	1146	Elm	146
Fir	180	Fir	80
In all	13226	Fallen	3455

From 13226
Take 3455

Rem. 9771

EXAMPLE 15.

The old *Salopian Par* was preſented by the *Earl* of *Arundel* to *King Charles the firſt*, at the age of 152, in the year 1635, how many years is that ſince?

From 1772
Take 1635

Anſ. 137 years.

EXAM-

EXAMPLE 16.

Once when I was at *Marbry School*,
My maſter JORDAN he,
Seem'd very croſs, and call'd me fool;
Which quite diſpleaſed me.
To me a queſtion he propos'd,
Which almoſt crack'd my brain,
To ſolve it many hours I pos'd,
But ſpent my time in vain.
At length he aſk'd me if I'd ſped,
And with an angry frown,
I anſwer'd *no!* he box'd my head,
I thought he'd broke my crown.
The queſtion was no more than this,
Which I'll to you relate,
So eaſy ſolv'd but yet alas!
Ne'er enter'd in my pate.
The diff'rence 'twixt twice twenty five,
Twice five and twenty ſee,
You tell me or, as I'm alive,
You'll ne'er a ſcholar be.

This queſtion to ſome may ſeem a *paradoxical affair*, but 'tis no more than from twice 25 = 50, ſubtract twice five = 10 + 20 = 30.

		5
		5
Thus	25	—
	25	10
	—	20
From	50	—
Take	30	30
	—	—
Anſ.	20	the difference
	—	

COM-

COMPOUND SUBTRACTION.

To find the difference of two numbers when one or both are compound, or applicate quantities.

RULE.

Your numbers placed as before,
Deduct, the diff'rence leſs from more;
But if the lower number be
Any greater than th' top you ſee,
Add up ſuch figures more to this,
As next denomination is;
Then place the diff'rence down below,
And carry one to the next row.

Examples of Money.

EXAMPLE 1.

	£.	s.	d.	
From	19	14	5	½
Take	12	16	4	¼
Rem.	6	18	1	¼
Proof	19	14	5	½

EXAMPLE 2.

	£.	s.	d.	
From	96	15	11	¼
Take	84	19	10	½
Rem.	11	16	–	¾
Proof	96	15	11	¼

EXPLANATION of EXAMPLES, 1ſt, and 2d.

Take example 1ſt, and begin at the leaſt denomination ſaying, 1 from 2 and there remains 1 farthing, which place under the line thus ¼. Then ſubtract 4 from 5 and there remains 1 penny, which write down under its own denomination; and proceed

ceed to the ſhillings and ſay, 16 from 14 I cannot, but 16 from 20 and there remains 4, and the 14 which is above is 18, but it is more methodical to ſay, 16 from 14 I cannot, but 20 that I borrow to 14 is 34, 16 from 34 and there remains 18, as before. Then becauſe you borrowed 1 pound or 20 ſhillings, ſay 1 that I borrow'd and 2 is 3, 3 from 9 and there remains 6, 1 from 1 and there remains nothing, and the remainder is 6l. 18s. 1d. $\frac{1}{4}$ which add to the line above it, and the ſum will correſpond with the top line, which proves the work to be right, as may be ſeen by the operation.

To proceed to example 2d, ſay 2 from 1 I cannot, but 2 from 4 and there remains 2, 2 and the 1 in the line above is 3, but it is better to ſay, 2 from 1 I cannot, but 4 that I borrow to 1 is 5, 2 from 5 and there remains 3 *to wit* $\frac{3}{4}$. Then proceed to the pence, and ſay 1 that I borrowed and 10 is 11, 11 from 11 and there remains nothing. Then ſay 19 from 15 I cannot, but 20 that I borrow to 15 is 35, 19 from 35, and there remains 16, and laſtly begin with the pounds and ſay, 1 that I borrowed and 4 is 5, 5 from 6 and there remains 1. 8 from 9 and there remains 1, which numbers being all ſet down as you proceeded in the working, make the remainder or difference to be 11l. 16s. 0d. $\frac{3}{4}$ as may be ſeen in the example.

OBSERVATION.

As ſubtraction of money (*be the ſum ever ſo great*) is performed after the very ſame manner that the two preceding examples are, it is therefore quite unneceſſary to give any further explanations relating thereto, as thoſe already given are ſufficient to qualify any learner therein.

From

EXAMPLE 3.

	£.	s.	d.
From	189	16	10 ¼
Take	94	17	11 ¾
Rem.	94	18	10 ½
Proof	189	16	10 ¼

EXAMPLE 4.

	£.	s.	d.
From	9000	–	–
Take	1986	16	1 ¼
Re.	7013	3	10 ¾
Proof	9000	–	–

EXAMPLE 5.

	£.	s.	d.
Borrow'd of my friend	84	16	–
Paid him in cash and goods	79	16	9 ½
Remains unpaid	4	19	2 ½
Proof	84	16	–

EXAMPLE 6.

Suppose my half year's rent is 12 guineas, and that I have laid out for the land tax and other levies 3l 19s. 3d. ½ and for several repairs 2l. 9s. 4d. ½ What remains due to the landlord?

	£.	s.	d.	£.	s.	d.
Half year's rent				12	12	0
Land tax &c.	3	19	3 ½	6	8	8
Repairs	2	9	4 ½			
Balance due to the landlord				6	3	4

EXAM-

EXAMPLE 7.

A ſteward receives for his *grace the* DUKE of C * * * * the ſum of 5000l. 18s. out of which he has diſburſed upon the *Duke's* account, the ſum of 904l. 10s. 9d. What remains in the ſtewards hands, to pay his maſter?

	l.	*s.*	*d.*
From	5000	18	0
Take	904	10	9
Rem.	4096	7	3
Proof	5000	18	–

EXAMPLE 8.

A LADY left her *daughter* fair,
Twelve thouſand pound in gold,
To be diſtributed with care,
As underneath is told.
Firſt to a *niece* there muſt be paid,
Juſt fourteen hundred pound,
And half that ſum to *parſon Wade*,
To make his glaſs go round.
And to her maid Miſs *Nancy Hare*,
Three hundred pounds in caſh,
Who ſwells with pride and ſuch an air!
She apes my lady flaſh.
The *ſtew'rd* and *butler* each muſt have,
Juſt twice two hundred more,
And to a tenant *farmer brave!*
In ſhining pounds ſix ſcore.
The greaſy *cook*, each other *maid*,
B'ing *three* * *in number* they,

Had

* *Cook included.*

Had twenty guineas each one paid,
To make them fine and gay.
The coachman *Ralph* and footman *Dan*,
Ten guineas and a crown, * * *a piece.*
Which made them toss about the can,
In ev'ry market town.
When all these legacies were paid,
What did remain behind,
For *Miss* that blooming peerless maid,
Whose virtues made her kind?

				l.	*s.*	*d.*
Sum left	-	-		12000	0	0
	l.	*s.*	*d.*			
Niece -	1400	-	-			
Parson -	700	-	-			
Miss Nancy Hare	300	-	-			
Steward and Butler	400	-	-			
Farmer Brave	120	-	-			
Cook and the two other maids	63	-	-			
Coachman and Footman	21	10	-			
				3004	10	0
The Daughter's share				8995	10	0

A *Cooper*

Example 9.

A *Cooper's* bill upon a *farmer* is 24l. 10s. 11d. $\frac{1}{2}$ out of which he has received in *cash* 10l. in *corn* 4l. 16s. 8d. in *coals* 2l. 15s. 9d. $\frac{1}{2}$ and in *cheese* and *bacon* 15s. 5d. $\frac{1}{2}$. What remains due to the *Cooper*?

					l.	*s.*	*d.*
The Cooper's Bill.					24	10	11$\frac{1}{2}$
		l.	*s.*	*d.*			
Paid in	Cash	10	0	0	18	7	11
	Corn	4	16	8			
	Coals	2	15	9$\frac{1}{2}$			
	Cheese &c.	–	15	5$\frac{1}{2}$			
Balance due to the Cooper					6	3	0$\frac{1}{2}$

Example 10.

Humphry has in cash and effects to the value of 8000l. but is indebted to *Ambrose* 141l. to *Joseph* 60l. 14s. 9d. $\frac{1}{4}$ to *Titus* 84l. 18s. 6d. to *Aminadab* 176l. 18s. 1d. $\frac{3}{4}$ to *Simon* 340l. to *John* 678l. 18s. 4d. $\frac{1}{2}$ to *David* 987l. 18s. 4d. to *Henry* 548l. 19s. 11d. $\frac{1}{4}$ and to *Nebuchadnezzar* 671l. 18s. 4d. $\frac{3}{4}$. What is *Humphry* worth when all his debts are paid?

				£.	s.	d.
The amount of *Humphry's* cash and effects.				8000	—	—
Debts owing by him to the following persons.	£.	s.	d.			
Ambrose	141	0	0			
Joseph	60	14	9¼			
Titus	84	18	6			
Aminadab	176	18	1¾			
Simon	340	0	0			
John	678	18	4½			
David	987	18	4			
Henry	548	19	11¼			
Nebuchadnezzar	671	18	4¾			
				3691	6	5½
Humphry's neat estate				4308	13	6½

Troy Weight.

A *Lady* bought of a *Silver Smith* a silver tankard weighing 3lb. and 13 grains, and a silver cup 1lb. 2 oz. 10 dwt. and 16 grains. How much heavier is the tankard than the cup?

	(12) lb.	(20) oz.	(24) dwt.	gr.
From	3	—	—	13
Take	1	2	10	16
Rem.	1	9	9	21
Proof.	3	—	—	13

To subtract weights and measures is done in the same manner as money, only observe to borrow and add or repay according to each denomination.

Apothe-

Apothecaries Weight.

What is the difference betwixt 28lb. 10. oz. and 2lb. 5 oz. 3 dr. 2 scr. and 13 gr.

	(12) lb.	(8) oz.	(3) dr.	(20) scr.	gr.
From	28	10	–	–	–
Take	2	5	3	2	13.
Remains	26	4	4	–	7
Proof	28	10	–	–	–

Averdupoize Weight.

A waggon load of coals, being weighed, waggon and all, by a *machine* was 2 tons and 4 hundred. What was the weight of the coals when the waggon weighed alone 10 c. 2 qrs. and 14lb.

	(20) tons.	(4) c.	(28) qr.	lb.
From	2	4	–	–
Take	–	10	2	14
Answer	1	13	1	14
Proof	2	4	–	–

	(16)(16) lb. oz. dr.
Delivered ſilk in bales, &c.	76 12 9
Receed.	9 14 11
Difference	66 13 14
Proof	76 12 9

Long Measure.

From a certain town *A* to *London* is 26 miles, 4 furlongs and 16 poles, and from *A* to a *Windmill* on the road is 4 miles 7 furlongs and 34 poles. How far is the *Windmill* from *London*.

	(8) (40) mls. fur. pls.
From	26 4 16
Take	4 7 34
Rem.	21 4 22
Proof	26 4 16

Cloth Measure.

A linen draper bought at *Cheſter Fair*, 496 yards of *Iriſh cloth*, out of which he has ſold 289 yards 2 quarters and 3 nails. How much remains unſold.

	(4) (4) yds. qr. nls.
From	496 - -
Take	289 2 3
Rem.	206 1 1
Proof.	496 - -

Land.

Land Measure.

A *Gentleman* has a large tract of land, containing 207 acres, which he intends to convert into a ſpacious park, out of which he would firſt encloſe 24 acres, 2 roods and 18 poles for a manſion houſe, gardens &c. What will the content of the park be?

	ac.	(4) rd.	(40) pls.
From	207	–	–
Take	24	2	18
Rem.	182	1	22
Proof	207	–	–

Wine Measure.

A *Nobleman* hath two cellars, the larger contains of ſeveral kinds of liquors 2 tons and 1 hogſhead, and the other 1 ton, 2 hogſheads, 56 gallons, and 5 pints. How much liquor is there in the one more than the other?

	ton.	(4) hhd.	(63) gal.	(8) pts.
From	2	1	–	–
Take	1	2	56	5
Rem.		2	7	3
Proof	2	1	–	–

Ale and Beer Measure.

A *Brewer* delivers in one day to his cuſtomers, 12 hogſheads and 4 gallons, in another day 15 hogſheads and 47 gallons. What is the difference?

		(51)
	hhds.	gal.
From	15	47
Take	12	4
Rem.	3	43
Proof	15	47

Dry Measure.

Out of 9 quarters and 1 comb, take 2 pecks.

		(2)	(4)	(4)
	qrs.	com.	bu.	pks.
From	9	1	–	–
Take	–	–	–	2
Rem.	8	–	3	2
Proof	9	1	–	–

Time.

Jacob agrees by contract to ſerve *Laban* 14 years for his two daughters *Leah* and *Rachel*, how long had

had he to ſerve when 10 years, 10 months, 10 weeks, 10 days, 10 hours, 10 minutes, and 10 ſeconds of that time were elapſed?

	(12)	(4)	(7)	(24)	(60)	(60)
	yrs.	mo.	we.	da.	ho.	min.	ſec.
From	14	–	–	–	–	–	–
Take	11	0	3	3	10	10	10
Anſwer	2	11	–	3	13	49	50
Proof	14	–	–	–	–	–	–

PROMISCUOUS QUESTIONS.

Queſtion 1ſt. By Mr. *Charles Hutton*, ſee his Arithmetic *p.* 144.

A was born when *B* was 21 years of age. how old will *A* be when *B* is 47, and what will be the age of *B* when *A* is 60?

From	47	To	60
Take	21	Add	21
Rem.	26 the age of *A*.	Sum	81 *B*'s age.

Queſtion 2d. By Mr. *Clare*. Recreation, 4.

When the air preſſes with its full weight in very fair weather, it may be demonſtrated that there preſſes upon a human body about 33905 pounds of that fluid matter; and in foul weather when the air is moſt light but 30624 pounds; what difference of weight lies on ſuch a body, in the two greateſt alterations of the weather?

	lb.
From	33905
Take	30624
Rem.	3281 of averdupoize weight.

Queſtion 3.

Queſtion 3. From Mr. *Birk's* Arithmetic, *page* 15.

In the city of *Pekin* in *China* is a bell weighing it is ſaid 120000lb. at *Nankin* in the ſame country is another weighing 50000lb. the firſt exceeds the great bell at *Erford* in *Upper Saxony* by 94600lb. How much then is the *German* bell inferior in weight to the ſecond?

	lb.	
Firſt from	120000	
Take	94600	
Rem.	25400	weight of the *German* bell.

	lb.
Then from	50000
Take	25400
Anſwer	24600

Queſtion 4. By Mr. *Daniel Fenning*, ſee his Arithmetic, *p.* 70.

A boy had 1000 marbles, and he loſt at 3 different times at play each 175, and at another time 150. How many has he ſtill in hand?

Write down the No. loſt each time which add together	175 175 175 150	From	1000
		Take	675
		Rem.	325
Loſt in all	675		

MUL-

MULTIPLICATION.

Of *Simple* or *abſtract* Numbers.

BY this *compendious rule* we find,
More uſeful arts, to pleaſe the mind;
It teaches how *addition* may
Be taught in a more curious way;
That is, how often unity,
In any number there ſhall be.

TABLE invented by *Pythagoras*.

This table *muſt be got by heart* and is ſo eaſy that it ſcarce needs any explanation, for 'tis no more than looking for one of the figures or factors at the top, and the other at the left hand ſide and the angle of meeting is the product, as for example. Suppoſe you wanted to to know which , or otherwiſe look

look for 7 on the ſide and 6 at the top, and in either angle of meeting you will find 42 the product of 6 times 7, or 7 times 6, by which you ſee that it does not ſignify which of the figures or factors you look for at the top or ſide, for if you look for either one at the top and the other at the ſide, the angle of meeting is ſure to ſhew you the product.

RULE.

First multiply from the right hand,
According as your figures ſtand,
Write down what overplus you ſee
Above the tens, whate'er they be.
Which tens to your next product add,
And ſoon the anſwer may be had;
As demonſtration plain doth ſhew,
If you'll proceed as taught below.

EXAMPLE I.

Multiply	6874	Multiplicand
By	4	Multiplier
	27496	Product

EXPLANATION.

To work this example you muſt ſay, 4 times 4 *is* * 16, ſet down 6 and carry 1, and 4 times 7 is 28 and 1 *is* † 29, ſet down 9 and carry 2 (*viz.* 2 tens) then ſay 4 times 8 is 32 and 2 is 34, ſet down 4 and carry 3, and laſtly 4 times 6 is 24 and 3 is 27 which ſet down, and the product will be 27496.

---

* That is, *the product of* 4 times 4 *is* 16, the words *the product of*, in multiplying being always underſtood.

† That is, *the ſum of* 28 and 1 *is* 29, the words *the ſum of* in adding being always underſtood.

LEMMA

LEMMA.

If you take any multiplicand and write it down as many times as the multiplier conſiſts of units (remembering as in addition, to place units under units, tens under tens &c.) and add them up the ſum will be equal to the factors (*viz.* the multiplicand and multiplier) multiplied into each other.

Now to prove the foregoing Example, ſet down the multiplicand 4 times as *per Lemma*.

thus 6874
6874
6874
6874

and the ſum is 27496 the ſame as the product.

EXAMPLE 2.

Multiply 146789
By 6

Product 880734

EXPLANATION.

Here ſay 6 times 9 is 54, ſet down 4 and carry 5, 6 times 8 is 48 and 5 is 53, ſet down 3 and carry 5, 6 times 7 is 42 and 5 is 47, ſet down 7 and carry 4, then 6 times 6 is 36 and 4 is 40, ſet down 0 and carry 4, 6 times 4 is 24 and 4 is 28, ſet down 8 and carry 2, 6 times 1 is 6 and 2 is 8, which compleats the product.

EXAMPLE 3.

EXAMPLE 3.

Multiply	865434
By	8
Product	6923472

EXAMPLE 4.

Multiply	756789
By	12
Product	9081468

These examples are multiplied after the same manner, as the two preceding ones.

EXAMPLE 5.

Multiply	543214
By	16
	3259284
	543214
Product	8691424

CASE 1.

When one of the factors consists of any number between 12 and 20, it may be multiplied in one line, as may be seen by working the last example in the following manner.

	543214
	16
Product	8691424 the same as above

Begin

Explanation.

Begin and ſay 6 times 4 is 24, ſet down 4 and carry 2, 6 times 1 is 6 and 2 is 8 and 4 the back figure makes 12, ſet down 2 and carry 1, 6 times 2 is 12 and 1 is 13 and the back figure 1 makes 14, ſet down 4 and carry 1, 6 times 3 is 18 and 1 is 19, and the back figure 2 is 21, ſet down 1 and carry 2, 6 times 4 is 24 and 2 is 26, and the back figure 3 makes 29, ſet down 9 and carry 2, 6 times 5 is 30, and 2 is 32, and the back figure 4 is 36, ſet down 6 and carry 3 to 5 is 8, which ſet down and the product is the ſame as when you multiplied by each figure in the multiplier ſeparately.

Corollary.

After the ſame method you may multiply any number of figures expreſſed in the ſame manner, with *ones* before the right hand figure, by adding the back figures to the product according to their places. But this method is not ſo uſeful, and ready (in my humble opinion) as the former.

Case 2.

When the multiplier contains more than one figure, multiply each figure thro' the line, and write down the products according to their places. Add them up and you will have the true product in one line.

Example 6.

Multiply 564217
By 27

3949519
1128434

Product 15233859

Begin and multiply the multiplicand by the firſt figure in the multiplier namely 7, and the product will be 3949519, then multiply the multiplicand by 2 the other figure of the multiplier, and the product will be 1128434 which ſet down according to their places, and add them together, and you will diſcover the true anſwer or product, as you may ſee by the example wrought in the preceding page.

EXAMPLE 7.

Multiply 941678
By 345

4708390
3766712
2825034

Product 324878910

SCHOLIUM.

To prove multiplication there are two ways, one whereof (and which I think is preferable to the other) is to multiply the multiplier by the multiplicand, and if the product is the ſame as the other, then the work is undoubtedly right.—To prove this take the preceding example.

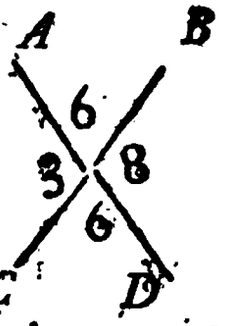
345
941678

2760
2415
2070
345
1380
3105

Product 324878910 the ſame as before

The

The other way which is moſtly taught in ſchools, but often liable to error, is very expeditious and is thus performed.



To prove the preceding example by this method, make a croſs as *A B C D*, add up all the figures of the multiplicand, and caſt away all the *nines* as you go on, thus, the firſt figure being 9, caſt that away and ſay 4 and 1 is 5 and 6 is 11, caſt away 9 and there reſts 2, then 2 and 7 is 9, and 8 remains, which place on the right hand ſide of the croſs, then caſt away the *nines* in the multiplier, thus; 3 and 4 is 7 and 5 is 12, caſt away 9 and there remains 3, which place on the left ſide of the croſs, then multiply theſe two numbers into each other, and caſt out the *nines* in the product, thus; 3 times 8 is 24, caſt away the *nines* and 6 remains which place at the top of the croſs; this being done caſt away the *nines* out of the product, thus; 3 and 2 is 5 and 4 is 9, then 8 and 7 is 15, caſt out 9 and there reſt 6, 6 and 8 is 14, caſt out 9 and there reſt 5, 5 and 1 is 6 (the 9 being rejected) which place at the bottom of the croſs, and the product is right.

EXAMPLE 8.

Multiply 4654301
By 6789

41888709
37234408
32580107
27925806

Product 31598049489

CASE 3.

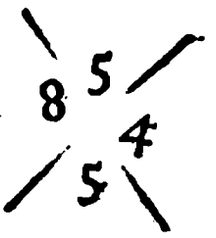
Whenever it happens that one or both of the factors end with a cipher or ciphers, or have ciphers between the figures, you may neglect the ciphers and multiply the remaining figures (as taught before,) to this product annex the ciphers, but take care to write down or begin the firſt figure in the product, according to its place in the leſſer factor, or multiplier. The following examples wrought out at full length will ſufficiently explain the ſame.

EXAMPLE 9.

Multiply 1456789
By 40607

10197523
8740734
5827156

Product 59155830923



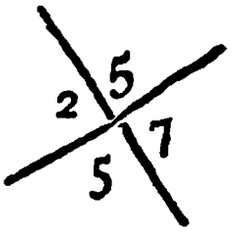
Note. In the above example or any other wherein there are ciphers between the figures in the multiplier; there is no occaſion (unleſs you are ſo minded) to take any notice of ſuch ciphers, but begin the product of the next figure, directly under its place in the given factor.

EXAMPLE 10.

Multiply 860074000
By 50040020

17201480000
344029600000
430037000000

Product 43038120161480000



Note

Note 2. In this example it is needleſs to put down the firſt quantity of ciphers to the product of each ſingle line, for you need do no more with ſuch ciphers, than annex the number thereof in both factors on the right hand together, when you add up the product.

CASE 4.

When you have any factor to multiply by 10, 100, 1000 &c. annex as many ciphers thereto as there are in the multiplier, and it is done.

Multiply	1771	1771	1771
By	10	100	1000
Product	17710	177100	1771000

CASE 5.

When large multiplications occur, and are brought into practice, as ſuppoſe it were required to multiply 2416735 by 67489, you may make a ſmall tariff or table, thus; make a ladder of 9 or 10 ſteps, againſt the 1ſt, ſtep ſet the multiplicand, againſt the 2d, its double. the 2d, ſtep added to the firſt gives the 3d ſtep, and the 3d added to the 1ſt, gives the 4th ſtep, thus proceed till you have 10 ſteps, which laſt ſtep, being ten times the multiplicand or 1ſt ſtep, proves the table to be right.

1	2416735
2	4833470
3	7250205
4	9666940
5	12083675
6	14500410
7	16917145
8	19333880
9	21750615
10	24167350

Operation.

	2416735
	67489
9th ſtep	21750615
8 ——	19333880
4 ——	9666940
7 ——	16917145
6 ——	14500410
Product	163103028415

SCHOLIUM.

I might now introduce various other methods of contracting and working *Multiplication*, by ſhort (tho' I may truly ſay tedious, perplexing, and inſignificant) rules, *Nepier's* Bones, &c. but theſe I ſhall omit as uſeleſs, and proceed to give the ingenious *Tyro* a few queſtions for practice and improvement, and then ſhew the extenſive uſe of compound multiplication; ſo very uſeful in all affairs of public buſineſs trade and commerce.

Queſtion 1.

Admit 100 men take a prize and each man's ſhare amounts to 150l. What is the value of the prize?

l.
150
100

Anſwer 15000

Queſtion 2.

A *careful maid* had thirty hens,
Laid twenty eggs *per* day,
She took great care to ſearch her pens,
Wherein her treaſure lay.
The eggs ſhe ſold, the caſh put by,
Still to increaſe her ſtore,
Reſolved was to buy a cow,
With five pounds and no more.
How many eggs, muſt there be ſold,
To purchaſe *Tydy* *. ſay?
At five for two-pence, pray unfold
The ſame, for *Nancy Ray*.

* *The name of the cow.*

First

First, multiply 100 ſhillings = 5l.
By 6 the two-pences in 1s.

2d multiply	600	two-pences
By	5	eggs
Anſwer	3000	eggs

Note, the number of days ſhe will be in raiſing money for her cow, is eaſily told by diviſion to be 150, but this muſt be referred to its proper place.

Queſtion 3.

At *Hackney* a country village in *Middleſex*, it is ſaid there are 500 houſes in it; now allowing 6 perſons to each houſe, what number of people are there in all?

	500
	6
Anſwer	3000

Queſtion 4.

The water works at *London Bridge* are ſaid to raiſe 1954 hogſheads in an hour, to the height of 120 feet; now ſuppoſe they work 8 hours every day, one day with another. How many hogſheads will be raiſed up in one year?

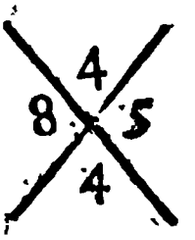
Multiply

Multiply 1954 the hhds. raiſed in an hour.
By 8

Mult. 15632 the hhds. raiſed in a day.
By 365 the days in a year

78160
93792
46896

Anſ. 5705680 hogſheads



Queſtion 5.

Near to St. *James's*, in the park you'll find,
A fair canal delightful to mankind,
Where ſportive fiſhes gliding jump and play
When *Phœbus* warms them with refulgent ray.
The chearful warblers in ſoft accents ſing,
And harmony encores the joys of ſpring.
The crouded mall in glitt'ring luſtre ſhines,
And nature's ſcen'ry in itſelf combines.
The *duke* and *earl*, the *ſtar* and *garter'd* knight,
And *ladies* glance along in ſilver white.
Th' area of this liquid ſpace you'll find,
From what you ſee is underneath ſubjoin'd *.

To find the area of a rectangular figure (of which form the canal is) is no more than to multiply the length, by the breadth, whether it be land, water,

* Length 2800 feet, breadth 100 boards,

boards, or any other flat or ſuperficial meaſure, and the product is the content or area.

Length 2800
Breadth 100

Area 280000 Feet

Queſtion 6.

Babylon once a famous and antient city in *Egypt*, ſtood upon a ſquare of 15 *miles* each way. How much ground did the whole city ſtand upon?

Multiply 15
By 15 } the length of a ſide.

75
15

Area 225 miles

COMPOUND MULTIPLICATION.

To multiply numbers of different denominations by any given number, obſerve the following

RULE.

Take care at firſt to multiply
Your prices by the quantity,
And when that number does exceed,
The number 12, beſure take heed,
Two numbers from your table take,
Which multipli'd together make

The

The quantity—then multiply
By each, and you'll the ſum deſcry,
The worth I mean, at ſuch a price,
The method is exceeding nice.
And when your quantity's compos'd,
Of numbers odd, perhaps you're pos'd,
And ſcratch your head—but I'll ſet clear,
A method in an inſtant here.
Two numbers take, whoſe product ſee,
Comes neareſt to the quantity.
Under or o'er, it matters not,
For ſoon an anſwer may be got,
By adding if the number's leſs,
(Than what your quantity's expreſs)
As many times the price you ſee
Is wanting, then complete you'll be.
But if your product ſhou'd make more
Than what your number does require,
Then from ſuch quantity ſubtract
As many times the price exact,
And then your query ſolv'd will be,
With eaſe and perſpicuity.

SCHOLIUM.

Multiplication of applicate numbers, is a compendious and ſhort way of working the Rule of Three, by an eaſy method, without the uſe of Diviſion, and is preferable to any other method, in many caſes in buying, ſelling, and computing the value of various commodities, as cattle, corn, cheeſe, &c. &c. &c.

EXAMPLE I.

What come 3 oxen to at ten guineas *per* ox?

l.	*s.*
10	10
	3
Anſwer 31	10

When

When you are to multiply compound quantities, always begin with the loweſt denomination, and carry to the next, writing down the overplus under its own denomination, and to work this example ſay, 3 times 10 is 30 ſhillings or 1l. 10s. write down 10 and carry 1, then ſay 3 times 10 is 30 and 1 is 31 pounds, which ſet down and the anſwer is 31l. 10s. as may be ſeen in the example.

EXAMPLE 2.

What come 6lb. of ſugar to at $5\frac{1}{4}$ *per* pound?

	d.
	$5\frac{1}{4}$
	6
Anſwer	2 $7\frac{1}{2}$

Here ſay 6 times 1 is 6 farthings or 1d halfpenny, ſet down $\frac{1}{2}$ and carry 1, then 6 times 5 is 30, and 1 is 31 pence or 2s. 7d. which enter down and the product is 2s. 7d. $\frac{1}{2}$ the anſwer to the queſtion.

EXAMPLE 3.

What do 9 yards of Iriſh cloth come to at 2s. 4d. $\frac{1}{2}$ *per* yard?

	s.	*d.*
	2	$4\frac{1}{2}$
		9
Anſwer	1 1	$4\frac{1}{2}$

EXAM-

EXAMPLE 4.

What come 12 c. of cheese to at 1*l.* 13*s.* 6*d.* *per* hundred?

l.	*s.*	*d.*	
1	13	6	
		12	
20	2	—	Answer

Note, cheese-factors and many other dealers, who buy goods by wholesale, are allowed 120lb. or 6 score to 1 c. wt. but sell them out at 112lb. *per* c. wt.

EXAMPLE 5.

What do 15 measures, or bushels of wheat come to at 6s. 9d $\frac{1}{2}$ *per* bushel?

6 $9\frac{1}{2}$

5

1 13 $11\frac{1}{2}$ price of 5 meas.

3

Answer 15 1 $10\frac{1}{2}$

Note, when the multiplier or given quantity is greater than 12, you must consider what 2 or more numbers multiplied together or continually make the quantity given, and multiply the given rate or price by either or any of those numbers (it matters not which you use first) and that product by the second and if you make use of any more numbers proceed in like manner, and the final product will be the answer as may be seen by the preceding example and the following ones.——And if the given quantity be ever so great, you may in like manner discover the value thereof, by finding the value of the greater and lesser numbers, and adding them together as directed by the *Lemma* at the end of this rule.

EXPLA-

Explanation of Example 5.

To work this Example ſay, 5 times 2 is 10 farthings or 2 pence ½ ſet down ½ and carry 2, then ſay 5 times 9 is 45 and 2 is 47 pence = 3s. 11d. ſet down 11 and carry 3, then 5 times 6 is 30 ſhillings and 3 is 33, = 1l. 13s. the firſt product being finiſhed, multiply that by the other number ſaying, 3 times 2 is 6 farthings or 1d. ½, ſet down ½ carry one and ſay, 3 times 11 is 33, and 1 is 34 pence = 2s 10d. ſet down 10, and carry 2, then 3 times 3 is 9 and 2 is 11, ſet down 1 and carry 1 and ſay. 3 times 1 is 3 and 1 is 4, 4 ten ſhillings, or 2l. then 3 times 1 is 3 and 2 is 5l. and the anſwer is 5l. 1s. 10d. ½.

Example 6.

A *dairy maid* deck'd with an air,
Each market-day you'll ſee,
Who brings to *town* her *country ware*,
Amiable and free.
Eggs, butter, bacon, cheeſe to ſell,
Good houſewifery ſuppoſe,
Which does become the *fair one* well,
She blooming as the roſe.
Her butter's value *Tyro* ſhew
And each commodity,
Say what do *eighteen pounds* come to,
At *four pence halfpenny*? *
And *ſix ſcore eggs* when *five* are ſold,
For *two pence* and no more,
All this with eaſe you may unfold,
And likewiſe too explore
What *thirty pounds* of cheeſe come to,
At *three pence farthing* ſay, *

* *Per* pound.

All this with eaſe you'll quickly do,
Come haſte make no delay.
Suppoſe *per pound* her bacon ſold,
At *five pence farthings three*,
Take *Wilkes's* number ‡ and unfold, ‡ 45
The value true to me.

		d.
1ſt,		$4\frac{1}{2}$
		9
S	3	$4\frac{1}{2}$
		2
S	6	9 value of the butter.

2d. It is evident as the eggs were ſold out at 5 for two pence, 24 or its component parts muſt be the multiplier for $5 \times 24 = 120$ the whole number of eggs.

Then $24 \times 2 = 48$d. $=$ 4s. the value of the eggs.

		d.
3d.		$3\frac{1}{4}$
		10
S	2	$8\frac{1}{2}$
		3
S	8	1 $\frac{1}{2}$ value of the cheeſe.

4th,

	d.
4th,	$5\frac{3}{4}$
	9
	$4\ 3\frac{3}{4}$
	5
£	1 1 $6\frac{3}{4}$ value of the bacon.

	s.	*d.*
Butter	6	9
Eggs	4	–
Cheese	8	$1\frac{1}{2}$
Bacon	1 1	$6\frac{3}{4}$
£	2 –	$5\frac{1}{4}$

EXAMPLE 7.

What do 56 hogs come to, at 15s. 6d. *per* hog?

s.	*d.*
15	6
	8
16	4 –
	7
Answer £ 43	8 –

EXAMPLE 8.

What come 77 acres of land to, at 1l. 4s. 6d. *per* acre?

l.	*s.*	*d.*
1	4	6
		11
13	9	6
		7
£ 94	6	6

EXAM-

EXAMPLE 9.

What come 81 roods of ſawing to, at 7s. 6d. *per* rood?

	s.	d.
	7	6
		9
	3	7	6
			9
Anſwer £	30	7	6

Note Sawyers &c. allow 400 ſquare feet, to one rood of boards.

EXAMPLE 10.

What come 96 meaſures of barley to, at 3s. 2d. ½. *per* meaſure?

	s.	d.	
	3	2	½
			12
	1	18	6
			8
Anſwer £	15	8	-

EXAMPLE

EXAMPLE 11.

What do 99 ſolid feet of oak timber come to, at 1s. 6d. ½ *per* foot?

s.	*d.*	
1	6	½
	11	
16	11	½
	9	
Anſwer £ 7	12	7 ½

EXAMPLE 12.

Old *Farmer Careful* fond of pelf,
To *Badger Fairtongue* ſold
His *wheat*, and ſeems to hug himſelf,
And ſmile upon the gold.
A *hundred buſhels* were agreed,
The *badger* ſtraight to bring,
At *nine and ſix-pence!* * true indeed, * *per buſhel*
It made old *Careful* ſing.
What did the whole come to declare,
Which pleaſed *Clod* ſo well,
And made him hobble ſing and ſtare,
Ingenious *Tyro* tell?

s.	*d.*	
9	6	
	10	
4	15	-
	10	
Anſwer 47	10	-

EXAMPLE 13.

What will 144lb. of tea come to, at 4s. 6d. $\frac{1}{2}$ *per* pound?

	s.	*d.*
	4	6 $\frac{1}{2}$
		12
	2	14 6
		12
Anſwer *l*	32	14 –

EXAMPLE 14.

What come 19lb. of figs to, at 3d. $\frac{3}{4}$ *per* pound?

		d.		
		3	$\frac{3}{4}$	
		6		
	1	10	$\frac{1}{2}$	
			3	
Add	5	7	$\frac{1}{2}$	price of 18lb.
		3	$\frac{3}{4}$	1
Anſwer *S*	5	11	$\frac{1}{4}$	price of 19

In this example as no two numbers multiplied together make the quantity, I take the two neareſt under it, which are 6 and 3 for $6 \times 3 = 18$ then 1 remains, the price of which muſt be added to the value of 18, and conſequently the ſum will be the price of 19 as above.

EXAM-

EXAMPLE 15.

What come 38 ſheep to, at 6s. 9d. *per* ſheep?

s.	d.			
6	9			
	10			
3	7	6		
		4		
				ſheep
From 13	10	–	the price of	40
Take	13	6		2
Rem. £ 12	16	6	the price of	38 Anſwer

In this example I have taken the two neareſt numbers above the given quantity, whoſe product is 40, by which I found the value of that number of ſheep to be 13l. 10s. from which I ſubtracted twice the price of one ſheep to find the price of 38, the anſwer to the queſtion.

EXAMPLE 16.

What come 52lb. of cheeſe to, at 4d. $\frac{1}{4}$ *per* pound?

		4	$\frac{1}{4}$		
		10			
	3	6	$\frac{1}{2}$		
		5			
					lb.
To	S 17	8	$\frac{1}{2}$	the price of	50
Add		8	$\frac{1}{2}$		2
Anſ. S	18	5		the price of	52

EXAMPLE 17.

Bought 67 loads of hay at 1l. 12s 6d. *per* load, what do they come to?

	l.	*s.*	*d.*		
	1	12	6		
			11		
	17	17	6		
			6		
					loads
To	107	5	–	} the price of {	66
Add	1	12	6	}	1
Answ. £	108	17	6	the price of	67

EXAMPLE 18.

Admit a master tradesman has done 86 days work, at 2s. 2d. *per diem*, what is the whole of his wages?

	s.	*d.*		
	2	2		
		12		
	1	6	–	
			7	
				days
To	9	2	–	} the price of { 84
Add		4	4	} 2
Answ. £	9	6	4	the price of 86

EXA-

EXAMPLE 19.

What come 106 yards of linen cloth to, at 1s. 8d. *per* yard?

	s.	d.		
	1	8		
		10		
	16	8		
		10		
To	8	6	8	the price of 100 yards
Add	–	10	–	the price of 6
Anſ. £	8	16	8	the price of 106

EXAMPLE 20.

What come 126 buſhels of beans to, at 4s. 2d. $\frac{1}{2}$ *per* buſhel?

	s.	d.		
	4	2	$\frac{1}{2}$	
		10		
	2	2	1	
		12		
To	25	5	–	the price of 120 buſhels
Add	1	5	3	the price of 6
Anſ. £	26	10	3	the price of 126

EXAM-

EXAMPLE 21.

What come 1 c. *viz.* 112lb. of hops to, at 1s. 2d. $\frac{1}{2}$ *per* pound?

s.	*d.*	
1	2	$\frac{1}{2}$
		8
9	8	
	7	
3	7	8 price of $\frac{1}{2}$ c. or 56lb.
		2
£ 6	15	4

Answ. £ 6 15 4

In this example I first find the price of $\frac{1}{2}$ c. or 56lb. which multiplying by 2 (the number of half hundreds in a hundred) I find the price of the hundred to be 6l. 15s. 4d. as may be seen by the operation.

EXAMPLE 22.

What comes a ton of cheese to, at 3d. $\frac{1}{4}$ *per* pound?

First multiply 112 by 20, to discover the number of pounds in a ton.

lb.
112
20
2240

d.		
3	$\frac{1}{4}$	
		8
2	2	
	7	
15	2	lb. the price of $\frac{1}{2}$ c. or 56
	10	half hundreds in 5c.
£7	11	8 price of 5 c.
		4
£30	6	8 the price of the ton.

This

This example requires the continual multiplication of the price of 1lb, by the four numbers 8, 7, 10, and 4, for by the two firſt, the price of half a hundred or 56lb. is diſcovered, and by the two laſt the price of the whole tun; ten times four being 40, the number of half hundreds contained therein.

Troy Weight.

Example.

Admit a Silverſmith has 5 bars of ſilver, each 4lb. 8oz. 10dwt. and 4 gr. What is the weight of the whole?

lb.	oz.	dwt.	gr.
4	8	10	4
			5
23	6	10	20

Note weights, meaſures, &c. are multiplied after the ſame manner as money, only remember to carry according to each denomination that reſpectively pertain thereto.

Apothecaries Weight.

Example.

An Apothecary has 7 mixtures, each 3lb. 2oz. 3dr. 2ſcr. and 12gr. What is the weight of the whole?

lb.	oz.	dr.	ſcr.	gr.
3	2	3	2	12
				7
Anſwer 22	5	3	-	4

AVERDUPOIZE WEIGHT.

EXAMPLE 1.

What is the weight of 10 caſks of raiſins when each caſk weighs 4c. 2qrs. and 20lb.

	c.	qrs.	lb.
	4	2	20
			10
Anſwer	46	3	4

EXAMPLE 2.

If a perſon hath 12 bales of ſilk, each 4lb. 11oz. and 10dr. What is the whole weight?

	lb.	oz.	dr.
	4	11	10
			12
Anſwer	56	11	8

LONG MEASURE.

EXAMPLE 1.

Multiply 40mls. 2fur. and 16pls. by 27.

	mls.	fur.	pls.
	40	2	16
			9
	362	5	24
			3
Product	1088	—	32

EXAM-

EXAMPLE 2.

Multiply 100 yards 1 foot and 4 inches by 35.

	yrds.	f.	in.
	100	1	4
			7
	703	-	4
			5
Product	3515	1	8

CLOTH MEASURE.

EXAMPLE.

If a ſhopkeeper bought 48 pieces of *Iriſh* cloth, each piece containing 32 yards 2 qrs. and 3 nails. What quantity did he buy?

	yrds.	qrs.	nls.
	32	2	3
			8
	261	2	-
			6
Anſwer	1569	-	-

Land Measure.

Example.

If a gentleman hath 64 pieces of land, each piece containing 6 acres 3 roods and 10 poles. What is the content of the whole?

	a.	r.	pls.
	6	3	10
			8
	54	2	–
			8
Anſwer	436	–	–

Wine Measure.

Example.

Multiply 8 tons 2 hhds. and 14 gall. by 98.

t.	hd.	gl.	
8	2	14	
		12	
102	2	42	
		8	
821	1	21	the product by 96.
17	–	28	the product by 2
838	1	49	the product by 98

Beer

Beer Measure.

Example.

Multiply 19 hhds. 2 kil. 6 gal. 6 pts. by 103.

h.	k.	g.	pts.
18	3	40	6
			10
197	2	16	4
			10
1979	2	12	—
59	1	3	2
2039	0	15	2

the product by 100 + 3 = 103

Dry Measure.

Multiply 6 lafts 3 qrs. 7 bu. 3 pecks, by 122.

l.	qr.	b.	pcks.
6	3	7	3
			12
76	7	5	—
			10
767	6	2	—
12	7	7	2
Anſw. 780	4	1	2
			12

product by 120 + 2 = 122

TIME.

Multiply 9 months, 2 weeks, 4 days, 12 hours, 4 minutes, by 130.

mths.	wks.	dys.	ho.	min.
9	2	4	12	4
				12
115	3	5	-	48
				11
From 1275	-	6	8	48 } the pro- { 132
Take 19	1	2	-	8 } duct by { 2
1255	3	4	8	40 130

LEMMA.

When any large sum or sums occur in practice, as hundreds, thousands, &c. 1st, multiply the price by 10. and that product by 10 for the value of one hundred. Then multiply that product by the number of hundreds. And for the lower numbers multiply the price of 10 by the number of tens, which product write down under the value of hundreds; and then for the units multiply the price by their number which add to the other products and the sum will be the value of the whole. If your quantity is thousands, multiply the price of 100 by 10 for 1000, and the product by the number of thousands. And for the lower quantities proceed as above. The following example will make this sufficiently clear to be understood.

What

EXAMPLE.

What come 8462lb. of iron to, at 2d. $\frac{3}{4}$ *per* pound?

		d.		
		2	$\frac{3}{4}$	the price of 1lb.
			10	
S	2	3	$\frac{1}{2}$	the price of 10lb.
			10	
£	1	2	11	the price of 100lb.
			10	
	11	9	2	the price of 1000lb.
			8	no. of thousands.

					lb.
	91	13	4		8000
	4	11	8	the price of	400
		13	9		60
			$5\frac{1}{2}$		2
Anſ. £	96	19	$2\frac{1}{2}$	the price of	8462

PROMISCUOUS QUESTIONS.

Question 1.

How many feet tails wings and claws,
Have thirty thrave of Jack Daws?

Multiply 24 = one thrave
By 30

720
9

6480

Question 2d. From Mr. *Clare's* Youth's Introduction to Trade and Buſineſs.

What is the difference, and what the ſum, of ſix dozen dozen, and half a dozen dozen?

12 a dozen
12

144 a dozen dozen
6

From 864 ſix dozen dozen
Take 72 half a dozen dozen

Diff. 792 To 864 ſix dozen dozen
Add 72 half a dozen doz.

Sum 936

Question 3.

Queſtion 3d. By Mr. *Clare.*

The *Silk-Mill* at *Derby* contains 26586 wheels, and 97746 movements, which wind off or throw 73726 yards of ſilk every time the great water wheel, which gives motion to all the reſt goes about, which is three times in a minute. The queſtion is, how many yards of ſilk may be thrown by this machine in a day, reckoning ten hours a day's work, and how many in the compaſs of a year, deducting for Sundays and Holydays 63 days, provided no part of it ſtands ſtill?

	73726	
	3	
	221178	yards in 1 minute
	60	minutes in an hour
	13270680	yards in 1 hour
	10	hours to the day as *per* queſ.
	132706800	yards in 1 day
	302	days in a year, excluſive of (the 63 holydays
	265413600	
	39812040000	
Anſwer	40077453600	yards in a year.

Queſtion 4:

Queſtion 4. By the celebrated Mr. *Malcolm.*

There are 7 cheſts of drawers, in each of which are 18 drawers, and in each of theſe are 6 diviſions, in each of which there is 16l. 6s. 8d. How much money is in the whole?

l.	*s.*	*d.*	
16	6	8	
		6	diviſions in each drawer
98	-	-	pounds in each drawer
18			drawers in each cheſt
784			
98			
1764			pounds in each cheſt
7			cheſts
Anſwer 12348			pounds in the whole

Queſtion 5. By Mr. *Daniel Fenning.*

If I ſpend 1d. $\frac{3}{4}$ or 7 farthings *per* day, how much is that in a year, allowing 365 days to the year.

	d.	
	1	$\frac{3}{4}$
	10	
S 1	5	$\frac{1}{2}$
	10	
14	7	
	3	
£ 2	3	9
	8	9
		$8\frac{3}{4}$
Anſwer £ 2	13	$2\frac{3}{4}$

DIVISION.

DIVISION teacheth to explore,
How often two's in twenty-four,
Or any numbers great or ſmall,
The product being the times in all.
Diviſion and ſubtraction are,
The ſame when numbers we compare,
This leſſon often has been took,
To be the hardeſt in this book,
In all arithmetical rounds,
Not fractions more with art abounds,
What I have written here to you,
George Fiſher * doth aver is true.

Of SIMPLE, *or* ABSTRACT *Numbers.*

RULE.

How to divide and be exact,
Firſt ſeek, then multiply, ſubtract,
Take care that your diviſors ſtand,
On the left ſide your dividend.
And that your quotient always be,
Upon the right, as here you ſee.

* See *Fiſher's* arithmetic *p.* 90.

EXAM-

Example 1.

Divide 691672 by 4

dividend

Diviſor 4) 691672 (172918 quotient

4

29
28

11
8

36
36

7
4

32
32

0

Explanation.

To work this example ſet down the diviſor and dividend as in the work, then aſk how oft 4 in 6, once, place 1 in the quotient and multiply the diviſor 4 thereby, ſaying once 4 is 4, which ſet down under 6 in

in the dividend and ſubtract ſaying, 4 from 6 and there remains * 2, to which bring down 9 the next figure in the dividend (and to avoid making miſtakes in bringing down the right figure, it will be neceſſary to prick under each figure in the dividend as you bring them down) then aſk how oft 4 in 29 anſwer 7, which place in the quotient and ſay 7 times 4 is 28 which ſet down under 29 and ſubtracting 28 from 29 there remains 1, to which bring down the next figure in the dividend namely 1, then aſk how oft 4 in 11, 2 times, place 2 in the quotient and ſay, 2 times 4 is 8 which ſet down under 11, and ſay 8 from 11 and there remains 3, to which bring down the next figure 6, and aſk how oft 4 in 36, place the anſwer 9 in the quotient and ſay, 9 times 4 is 36 which ſet down under 36 and ſubtract and there remains nothing, then bring down the next figure 7 and aſk how oft 4 in 7 place 1 the anſwer in the quotient and ſay once 4 is 4 which ſet down under 7 and ſubtract ſaying 4 from 7 and there remains 3, then bring down 2 the laſt figure in the dividend and ſay, how oft 4 in 32, ſet down the anſwer 8 in the quotient and multiply the diviſor thereby ſaying, 8 times 4 is 32, 32 from 32 and there remains nothing and the work is finiſhed, whereby it appears that the *figure* or *number* 4 *is* contained in 691672 juſt 172918 times, to diſcover which was the thing required. This queſtion is the ſame, as if one ſhould aſk in 691672 farthings how many pence? the anſwer wou'd be 172918 pence.

---

* That is, there remains *the number* 2, or *the number* 2 remains, *the number* in ſuch caſes being always underſtood.

EXAMPLE 2.

EXAMPLE 2.

Divide 86547 by 7

```
7) 86547 (12363
   7....
   ---
   16
   14
   --
   25
   21
   --
   44
   42
   --
   27
   21
   --
    6
   --
```

The above example is worked in the ſame manner as the former one, the quotient or times the diviſor 7 is contained in the dividend is 12363 and 6 remains.

EXAM-

EXAMPLE 3.

Divide 541678 by 12

```
12) 541678 (45139
    48
    ---
     61
     60
     --
      16
      12
      --
       47
       36
       --
       118
       108
       ---
        10 remainder
```

EXAMPLE 4.

Admit from *West Chester* to *London* I go,
Whose distance in miles I have placed below, †
If I trudge on my feet, just five days we'll allow
To compass the journey along with friend *Howe*:
What miles and odd yards must we travel each day,
Ingenious fair *Ladies* be pleas'd to display?

† 182 miles.

5) 182 (36 miles and 2 fifths of a mile =
15 704 yrds. for 2 × 1760 (the yrds.
in a mile) = 3520
32 divided by 5 = 704.
30
2

EXAMPLE 5.

Divide 89012 by 24

24). 89012 (3708
72
170
168
212
192
20 remains

EXPLANATION of *Example* 5.

Having placed the numbers as in the work, aſk how oft 24 in 89, or which is better, how oft 2 in 8, and you may ſoon diſcover that 4 times will be too many, for 4 times 2 is 8, and you will have 1 to carry thereto from the other figure in your diviſor, therefore place 3 in the quotient and multiply the diviſor thereby, ſaying 3 times 4 is 12 ſet down 2 under the 9 and carry 1 and ſay, 3 times 2 is 6 and 1 is 7 which ſet down under the 8 and ſubtract, ſaying 2 from 9 and

and there remains 7, 7 from 8 and there remains 1, then bring down the 0 and enquire how oft 2 in 17, which will be but 7 times becauſe you will have 2 to carry from the other figure of the diviſor, therefore ſet down 7 in the quotient and multiply the diviſor thereby, the product is 168 which place under 170, then ſubtract and the remainder is 2, bring down the next figure (of the dividend) 1 and ſee how oft the diviſor 24 in 21, anſwer 0 times, place a cipher in the quotient and bring down 2 the laſt figure of the dividend, then ſeek how oft 24 in 212, or how oft 2 in 21, the two firſt figures in the new dividend, which cannot be 9 times becauſe 9 times 24 is 216 which you cannot take from 212 ſo you ſee it will be but 8 times, then place 8 in the quotient and multiply the diviſor thereby and the product will be 192. which place under 212 and ſubtract as before, and there remains 20, which ſet down and the work is finiſhed, and the quotient is found to be 3708 and 20 remaining. This queſtion is the ſame as if one ſhould aſk in 89012 halfpence, how many ſhillings? the anſwer would be 3708 ſhillings and 20 halfpence or ten-pence remaining.

Note. The remainder after every ſubtraction is always to be leſs than the diviſor, otherwiſe the work is wrong and muſt be rectified (before you can proceed farther) by increaſing the laſt found figure in the quotient until the remainder be leſs, and you muſt never bring down from the dividend more than one figure at a time, and for every figure you bring down, place or put a figure or cipher in the quotient.

EXAMPLE 6.

47) 8460 (180
47

376
376

0

SCHOLIUM.

There are various ways of proving diviſion, and for the exerciſe of the learner I ſhall prove it by three different ways, firſt by multiplying the quote by the diviſor, ſecondly by caſting away the *nines* as in multiplication, and laſtly by addition.

Firſt Method.

Take the quotient of the laſt example and multiply it by the diviſor.

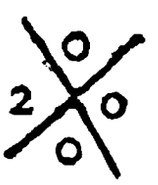
thus 180
47

1260
720

8460 Same as the dividend.

Second Method.

Take the ſame example and caſt away the *nines* in the diviſor and quotient, which put on each ſide of the croſs, and caſt away the *nines* out of the dividend, put the remainder at top of the croſs, then multiply the ſide



figures

figures thereof into each other, and caſt the *nines* out of the product, and if the work be right, the remainder to be wrote at the bottom of the croſs, will be the ſame as the top, as may be ſeen by this example.

The third method is thus, Add the laſt remainder and all the products of the diviſor and quotient together as they ſtand in the work, and the ſum will be the ſame as the dividend, as appears in the proof of the following example.

EXAMPLE 7.

Divide 746789 by 345

345) 746789 (2164
* 690

567
* 345

2228
* 2070

1589
* 1380

* 209 laſt remainder

Proof 746789

Now to prove this example add up all the lines mark'd thus * and as there is nothing but a cipher to add the 9 (in the laſt remainder) to, put it down, and for the ſame reaſon put down 8, then ſay 2 and 3

is 5 and 7 is 12 and 5 is 17, ſet down 7 and carry 1, then 1 and 1 is 2 and 4 is 6, ſet down 6, and ſay 2 and 3 is 5 and 9 is 14, ſet down 4 and carry 1, 1 and 6 is 7, which ſet down and the ſum is the ſame as the dividend, and proves that the diviſion was performed right.

EXAMPLE 8.

Divide 123456789 by 6004.

```
6004) 123456789 (20562
      12008
      -----
       33767
       30020
       -----
        37478
        36024
        -----
         14549
         12008
         -----
          2541 remains

Quotient 20562
Diviſor   6004
          -----
          82249
       12337454
       --------
Proof  123456789
```

Note. In proving diviſion by multiplying the quotient by the diviſor, if there be any remainder you muſt add it in, as you multiply *i. e.* when you multiply by units add the units, and when by tens add the tens &c. as you may ſee by the proof of this example.

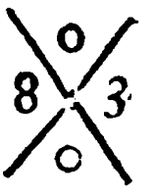
EXAMPLE 9.

EXAMPLE 9.

Divide 987654321 by 123456

123456) 987654321 (8000
987648

6321 rem.



To prove this example (and all others in diviſion that have remainders) by the croſs, you muſt, after having caſt out the *nines* in the quotient and diviſor and placed the remainder on each ſide of the croſs, caſt the *nines* out of their product, and what remains over, add to the remainders at the bottom of the work caſting out the *nines* and place the overplus at the top of the croſs; then caſt out the *nines* in the dividend, and the remainder you muſt place at the bottom of the croſs, which will be the ſame as the top if the work be right, as may be ſeen by the proof of this example.

COROLLARY.

When you have large numbers to divide by, you may often (if not always) by inſpection, tell how many times your diviſor is contained in its proper period or dividual, by obſerving how oft the two firſt figures on the left hand, are contained in the two firſt of the dividual.

Contractions in DIVISION.

CASE 1.

When you have ciphers on the right hand of your diviſor, cut of the ciphers, and alſo the ſame number of figures on the right hand of your dividend, which figures bring down to the right hand of your remainder, when the work is finiſhed.

Divide

Divide 1772 by 20

2 | 0) 177 | 2 (88

16

17 88

16 20

Rem. 12 1772 Proof.

Note. In this example I cut of the cipher and one figure in the dividend, and divided only by 2.

Divide 4816700 by 12000

12 | 000) 4816 | 700 (401 Quotient

48 Proof

401 × 12000 + 4700 = 4816700.

16

12

4700 remains

Divide 946789 by 10000

Quotient.

1 | 0000) 94 | 6789 ($94\frac{6789}{10000}$

9

Proof

4 94 × 10000 + 6789 = 946789.

4

6789 remains

CASE 2.

When the diviſor does not exceed 12 there will be no occaſion to ſet down the operation at large, for it may be performed by multiplying and ſubtracting mentally, and writing down the quotient under the dividend as may be ſeen in the following examples.

Divide 456789 by 8

8) 456789

Quote 57098——5 Proof

Divide 546294 by 12

12) 546294

45524——6
12

Proof 546294

EXPLANATION of *Example* 1st.

To work this example ask how oft 8 in 45, answer 5 times, set down 5 under the dividend, and say 5 times 8 is 40 from 45 and there remains 5 which makes the following figure 56, then say how oft 8 in 56, 7 times 8 is 56 from 56 and there remains nothing, then ask how oft 8 in 7 nought times, set down 0 and there remains 7, which makes the following figure 78, then say how oft 8 in 78, 9 times 8 is 72, from 78 and there remains 6 which makes the following figure 69, then seek how oft 8 in 69, 8 times 8 is 64 from 69 and there remains 5, which (as there is no more figures in the dividend) set down at the end of the quotient as a remainder and the work is compleated.

CASE 3.

CASE 3.

When it happens that the diviſor is the product of two or more numbers; you may divide by thoſe numbers or component parts, which is much eaſier than dividing by all the diviſor at once, ſee the following example.

Divide 946002 by 72

12) 946002

6) 78833—6 } 66

Quote 13138—5

6

78833

12

Proof 946002

Note. In proving by multiplication this example (and all others of the like kind) you muſt add or take in ſeparately the two remainders when you multiply by their reſpective diviſors that produced them, or which pertain thereto. And to bring theſe 2 remainders into *one* you muſt multiply the firſt diviſor into the laſt remainder, and add the firſt remainder in, as in this example 12 times 5 is 60 and add 6 (the firſt remainder) thereto, the ſum is 66 which will remain when the dividend in this example is divided at one operation by 72. But when there is 2 diviſors and but one remainder, and that proceeds from the laſt diviſor, then the product of the 1ſt diviſor and that remainder will be the remainder ſought. But when there is 2 diviſors and one remainder and it proceeds from the 1ſt diviſor, then that remainder is the remainder.

CASE 4.

CASE 4.

In large diviſions you may make a tariff or table (as taught in multiplication) by making products of the diviſor and the 9 digits, which is done by continually adding the diviſor, by which tariff or table any large diviſions are wrought by inſpection, and to do which you are only to take out of the table the neareſt leſs number to the dividual, and the quote figure along with it, which number muſt be continually ſubtracted from each dividual as before taught. The following example will make this clear.

Divide 41690314975 by 406502.

1	406502
2	813004
3	1219506
4	1626008
5	2032510
6	2439012
7	2845514
8	3252016
9	3658518
10	4065020

406502) 41690314975 (102558.

406502

1040114
813004

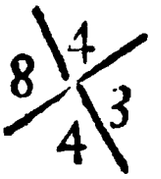
2271109
2032510

2385997
2032510

3534875
3252016

Remains 282859

Proof.



CASE 5.

Thoſe who are well acquainted with the nature of diviſion, may even in the largeſt diviſions, ſubtract each figure of the product as it is produced, and write down *only* the remainders. This is commonly called the ſhort *Italian* diviſion, to perform which take the laſt example.

divide

406502) 41690314975 (102558
1040114
2271109
2385997
3534875
282859 remains as before.

SCHOLIUM.

Having now ſufficiently explained *Simple Diviſion*, I ſhall give two or three more queſtions for exerciſe, and then proceed to applicate numbers, or diviſion of component parts.

Queſtion 1.

In the *Spectators*, number nine,
Where eloquence makes learning ſhine,
Sir *Richard Steele*, or *Addiſon*
Deſcribe a wond'rous ſet of men.
A club of men, exceeding queer,
As fat as bacon hogs they were;
True brawny bacchanalian ſouls
Who ſwill in large capacious bowls.
And bellies mounted to the chin,
A hogſhead might be loſt therein.
The *fifteen members* of this club,
Whoſe weight when weigh'd by Mr. *Scrub*,
Was juſt *three tons*, it was no more,
The weight of each then pray explore.

To anſwer this queſtion is only to divide 60 (the hundreds in 3 tuns) by 15 the number of men, thus 15) 60 (4 c. the weight of each man.
60
—
0
—

Queſtion

Queſtion 2.

Bethlehem Hoſpital, whoſe firſt benefactor was *Simon Fitzmary*, is in length 540 feet, and in breadth 40 feet. Now ſuppoſe there are 170 perſons provided for at the annual expence of 1000l. How much is that apiece?

Firſt $540 \times 40 = 21600$ the area.

17|0) 100|0 (5 *l.*
85

150
20

17|0) 300|0 (17 *s.*
17

130
119

110
12

17|0) 132|0 (7 *d.*
119

130
4

17|0) 52|0 ($\frac{3}{4}$
51
---
10 rem. Anſw. 5*l.* 17*s.* 7*d.* $\frac{3}{4}$ $\frac{10}{170}$

Queſtion 3. *For the Ladies.*

A *Governeſs* who well obſerv'd
The morals of the *fair*,
To ſee her *pupils* never ſwerv'd
From virtue, took great care,
Juſt *five and twenty Ladies* ſhe
Inſtructed, in each art,
Which does diſplay to company,
The moſt accompliſh'd part.
In *Needle-work*, and *Muſic* few
Could *Governeſs* excel,
She taught them *French* and *Dancing* too,
Incomparably well.
Both *Reading*, *Writing and Accompts*,
Grammatically were,
With freedom taught, each *Lady* mounts
An elevated ſphere.
To make her ſex with brilliance ſhine,
She took peculiar care,
When genius does with ſenſe combine,
To grace the lovely fair.
And to encourage ſprightly youth,
Upon a certain day,
Three hundred ſugar plums in truth,
She frankly gave away.
What number was each *Lady's* ſhare,
Ingenious fair ones ſay?
Which pleas'd no doubt the brilliant fair,
And made them dance and play.

25) 300 (12 Anſwer
25

50
50

0

COM-

COMPOUND DIVISION.

To divide numbers of different denominations by a given number, obſerve the following

RULE.

When your diviſors ſingle are,
To work your dividend prepare;
Your higheſt number firſt divide,
Be what it will on the left ſide.
Let each denomination be
The ſame, and with your quote agree,
What reſts reduce and add unto
The next inferior one you view.
Thus thro' your dividend go on,
But if your number's more than one
That you divide by, then you may
Work by their parts, an eaſy way,
When your diviſors ſhall agree,
In equal products quaint and free.

LEMMA.

This uſeful and excellent method of diviſion teaches how to find the price of 1 &c. in a more conciſe manner than the rule of Three or Reduction, for any perſon who has learned the four firſt rules in arithmetic, may eaſily by thought and memory bring out a final quote or anſwer, without a great multiplicity of figures, as will appear by the following examples. To prove compound diviſion, multiply the quotients by the proper diviſors.

Example 1.

Suppoſe 7 men are to pay a reckoning of 1l. 15s. 1d. ¼. What muſt each man pay?

	l.	*s.*	*d.*	
7)	1	15	1	¾
Anſwer	–	5	–	¼
				7
Proof	1	15	1	¾

Explanation. To work this example aſk how oft 7 in 1, never a time, then 1l. = 20s. added to 15s. is 35s. then aſk how oft 7 in 35, 5 times, put down 5 in the quotient and ſay 35 from 35 and there remains nothing, then aſk how oft 7 in 1d. never a time and there remains 1, one penny is 4 farthings and 3 is 7 how oft 7 in 7 once, ſet down 1 farthing and the anſwer is 5s. ¼.

Example 2.

A *Lady* had *nine Daughters* fair
Of bright accompliſh'd parts,
Their graces, ſmiles, and pleaſing air,
Attracted lovers hearts;
Young *Damon*, *Sylvius*, many more,
Their utmoſt art eſſay'd,
To gain theſe fair ones and implore
The favours of each maid.
The *Mother* was poſſeſs'd we find
Of *eighty hundred pound*,
And being virtuous, juſt and kind,
An equal ſhare left round
To be diſtributed with care,
Amongſt her daughters *nine*,
Each *Lady's* fortune pray declare?
To make your learning ſhine.

	£.	s.	d.
9)	8000	—	—
Answer	888	17	9 $\frac{3}{4}$
			9
Proof	8000	—	—

First ask how oft 9 in 80, answer 8 times, repeat the operations and 8 will remain in the pounds, which reduce to shillings and proceed thro' all the denominations, and each Lady's fortune will appear to be as above. To prove which take in the remainder to the farthings.

EXAMPLE 3.

If 18 cheeses (of equal weight) cost 7l. 9s. 3d. What is the price of one?

	£.	s.	d.	
6)	7	9	3	(9
3)	1	4	10 $\frac{1}{2}$	
Answer	—	8	3 $\frac{1}{2}$	
			3	
	1	4	10 $\frac{1}{2}$	
			6	
Proof	7	9	3	

In this example make use of two numbers *viz.* 6 and 3 whose product is 18.

EXAM-

EXAMPLE 4. *For the Ladies.*

Says *Hodge* to his *Grandmother*, Grannum I ſee,
That the *money* and *purſe* which you've given to me,
Is worth *ſixteen and eightpence*, it's well it's no worſe,
For the *caſh* is in value, worth *nine times the purſe*,
What ſum then had *Roger* fair *Ladies* pray tell,
Which tickled his fancy and pleas'd him ſo well?

s.	d.		s.	d.	
16	8	Then	16	8	
9		Minus	15	-	
10) 7	10	-	rem. 1	8	price of
Anſ. -	15	-			the purſe.

EXAMPLE 5.

If I ſell 81 buſhels of wheat for 30l. 7s. 6d. What is that *per* buſhel?

£.	s.	d.	
9) 30	7	6	
9) 3	7	6	
Anſwer -	7	6	

EXAMPLE 6.

If I ſell 100 buſhels of wheat for 47l. 10s. What is the price of a buſhel thereof at that rate?

£.	s.	
10) 47	10	
10) 4	15	
Anſwer -	9	6

EXAM-

EXAMPLE 7.

Admit a *Farmer* sells to a *Swailer*, or *Baker*, one load of wheat, which weighed in all 2250lb averdupoize weight, now suppose (as is customary) the *Farmer* allows 75lb. to the bushel, and sells the same after the rate of 6s. 4d. *per* bushel. I demand the whole number of bushels, and price of the whole?

First divide 2250 by 75, and you have the number of bushels = 30, then multiply the price of 1 bushel by the whole number (30) and you have the price of the whole.

Operation.

1st. by division 75) 2250 (30 bushels.
225
0

	s.	d.	
2d. by multiplication	6	4	
		10	
	3	3	4 the price of 10.
		3	
£	9	10	– the price of 30.

Note, When *Farmers* have their corn in different bags and each bag is weighed separately, they must take care to put down the weight of each bag, under each other; and add up the whole by the rules taught in simple addition.

A *quondam*

Example 8.

A *Quondam* neighbour *Farmer Giles*
Who dwells where cultivation ſmiles;
With *Seven Workmen* had agreed,
To marl a field in time of need,
For eight and ſixpence * they conſent,
And ſtraight to marl the workmen went,
They dig and fill the pregnant clay,
The loaded carts conduct away,
Till thirty acres were manur'd,
And then an *Artiſt* is procur'd
To make the pit's content be known,
As in the margin † I have ſhewn. † 2016 *yds.*
What roods, and what was each man's ſhare,
Ingenious *Tyro* pray declare?

		s.	*d.*
12)	2016	8	6
			7
6)	168		
	l.	2 19	6
Anſwer	28 roods.		4
		7) 11 18	– whole ſum
	Anſwer *l*	1 14	– each man's ſhare.

Example 9.

At a hunting ſuppoſe *ſix ſcore Gentlemen* be,
All ſons of fair freedom and dear *Liberty*;
The banquet prepar'd with old *Boniface* dine,
To feaſt and carouſe over punch ale and wine.

* *Per* rood of 72 ſolid yards.

With punch bowl and ladle they fill drink and ſing
And ſeem to adore mighty *Bacchus* the king.
For Bacchanals who favour the bottle and glaſs,
Will ſmile on full bumpers wherever they paſs.
If *ſixty-three pounds* do the reckoning defray,
Then what muſt *each Gentleman* equally pay?

	£.
12)	63
10)	5 5 *s.*
Anſw.	*S* 10 6 *d.* each.

EXAMPLE 10.

If 1 hund. weight of hops * coſt 6l. 15s. 4d. What is the price of 1 pound?

	£.	*s.*	*d.*
2)	6	15	4
7)	3	7	8
8)	–	9	8
Anſwer	–	1	2½

* See example 21 *page* 94, this being the reverſe of that and requires 3 diviſions.

COROLLARY.

When the diviſor can't be produced by multiplication of ſmall numbers, you muſt divide as in long diviſion.

EXAM-

EXAMPLE 11.

Divide 100l. 4s. 6d. ½ into 52 parts.

£.	s.	d.	
52) 100	4	6 ½	(1 £
52			
48			
20			
52) 964			(18 s
52			
444			
416			
28			
12			
52) 342			(6 d.
312			
30			
4			
52) 122			(½
104			
18			

Note, In this example each remainder is reduced to the next inferior denomination, and each sum whether shillings pence, or farthings added thereto.

£. s. d.
Anf. 1 18 6½ $\frac{18}{52}$

Note,

Note. The following queſtion I propoſed many years ago, which was publiſhed in the *Palladium* for 1760, and afterwards taken into *Birk's Arithmetic*, and as it ſeems a pretty exerciſe for the learners of diviſion, I ſhall therefore give it in this place before I proceed any further.

QUESTION.

A worthleſs *Miſer* as I'm told,
Had hoarded up vaſt ſtore of gold;
Large ſums put out to uſury,
Till aged *fourſcore Years* and *three*
When death depriv'd him of his pelf.
And took him from his ſecond ſelf:
Of wives it happen'd he'd had *three*,
Three Sons, and Daughters *two* had he.
His third wife did ſurvive him ſtill,
But mark the tenor of his will:
Of ruſty gold ten thouſand pound,
Was in this *Miſer's* coffer found;
Each Son muſt be paid down in ſtore
Each Daughter's fortune three times o'er,
Each Daughter as the will was made
Muſt twice the widow's part be paid:
Now the old *Miſer's* in his grave,
Tell me the fortune each muſt have.

SOLUTION.

It is evident by the nature of the queſtion, that for the widow's ſhare, 2 daughters had 4 ſhares, and 3 ſons 18 ſhares; whence $1 + 4 + 18 = 23$, a diviſor for the widow's part, now you muſt proceed to divide 20000 by 23 (as *per* laſt Example.)

Divide

	£.	s.	d.	
23) 10000 (434	15	7 $\frac{3}{4}$ $\frac{7}{23}$	= Widow's
which ſum × by		2	part.
869	11	3 $\frac{1}{2}$ $\frac{14}{23}$	= each daugh-
multiply by		3	ter's part.
8608	13	10 $\frac{3}{4}$ $\frac{19}{23}$	= each ſon's part.

CORROLLARY.

There being fractional parts in the above $\frac{7}{23}$ &c. you muſt multiply the parts, and if the products exceed the diviſor, ſubtract the diviſor 23 from the ſame and carry 1 to the farthings as you ſee above, when you ſay 3 times 14 is = 42 ſubtract 23 from 42 and there reſt 19, which makes $\frac{19}{23}$ and 1 farthing to carry to make $\frac{1}{4}$ in each ſons ſhare.

Of WEIGHTS MEASURES, &c.

Divide 23lb. 6 oz. 10 dwt. 20 gr. by 5. *

	lb.	oz.	dwt.	gr.
5)	23	6	10	20
Anſwer	4	8	10	4

* See example 1. page 30. Here as diviſion is the reverſe of multiplication I ſhall divide a few of thoſe examples to facilitate diviſion, and then proceed to reduction &c. To work the above example aſk how oft 5 in 23, 4 times and there remains 3, then 3 times 12 is 36 and 6 is 42 oz. then aſk how oft 5 in 42, 8 times, and there remains 2, two ounces or 40 dwt. 40 and 10 is 50, then how oft 5 in 5 once, how oft 5 in 0, nought times,

times, then aſk how oft 5 in 20, 4 times which compleats the quotient. In the ſame manner all weights and meaſures (paying a due regard to their ſeveral denominations) are divided with eaſe and accuracy.

EXAMPLE.

Divide 22lb. 5 oz. 3 dr. 1 ſcr. 4 gr. by 7.
ſee *page* 95.

	lb.	oz.	dr.	ſcr.	gr.
7)	22	5	3	1	4
Anſw.	3	2	3	2	12

EXAMPLE.

Divide 56 lb. 11 oz. and 8 dr. by 12. ſee *page* 96.

	lb.	oz.	dr.
12)	56	11	8
Anſw.	4	11	10

I ſhall now beg leave to conclude this rule as the learner by this time (*having had ſo many examples and explanations*) cannot but be able to comprehend or ſurmount every difficulty that can poſſibly occur relating to diviſion of any kind, and to effect which was my chief motive of dwelling ſo long therein.

PROMISCUOUS QUESTIONS.

Queſtion 1. By Mr. *Charles Hutton.*

The remainder of a diviſion is 325, the quote 467, the diviſor is 43 more than the ſum of both. What is the dividend?

Sol. By the nature of the queſtion and the rules in diviſion $325 + 467 + 43 = 835 \times$
$467 + 325 = 390270$. Anſwer.

Operation at length.

325
467

792
43
---

multiply 835 the diviſor
by 467 the quote, and take in 325 the remainder.

5850
5012
3343

Anſ. 390270 = dividend as above.

Mr. *Hutton's* Solution being wrong printed as I imagine.

Queſtion 2.

Queſtion 2. by Mr. *Clare*.

By ſelling 240 Oranges at 5 for two-pence, half of which coſt me two a penny, and the other half, 3 a penny I evidently loſt a groat, pray how comes that about?

First. 240
2
5) 480
d. 96 = what ſold for

2d. $\frac{1}{2}$ 120 = 60 and $\frac{1}{3}$ 120 = 40 then 60 + 40 = 100 (what bought for.

or thus 2) 120 (60
3) 120 (40
100 d.

d.
From 100
Take 96
Rem. 4d. loſt.

Queſtion 3. by Mr. *Hill*. See his Arith. *p*. 62.

A Captain and 160 Soldiers gain a prize worth 362*l*. of which the Captain had $\frac{1}{5}$ for his ſhare, the reſt was divided equally among the Soldiers; what was each Man's part?

5) 362
72 8 s. = Captain's ſhare.

	£.	s.	
From	362	–	the whole prize
Take	72	8	the Captain's ſhare
	289	12	for the Soldiers
	20		

16|0) 579|2 (36 ſhillings.
48

99
96

32
12

Anſwer each man's ſhare,
36s. 2d. $\frac{1}{4}$ $\frac{26}{100}$

16|9) 38|4 (2 d.
32

64
4

16|0) 25|6 ($\frac{1}{4}$ Mr. *Hill* makes it 36s. $\frac{3}{4}$.
16

rem. 96

The following Queſtion (as Mr. *Malcolm* juſtly obſerves) requires all the four operations of Arithmetic.

Queſtion 4.

Queſtion 4. by Mr. *Malcolm.*

A Father left among 5 Sons an eſtate, conſiſting of 500*l.* in caſh, with 5 bills, each of 48*l.* 10*s.* 6*d.* he ordered 20*l.* to be beſtowed upon his burial, and his debts to be paid amounting to 164*l.* Then his free eſtate to be divided in this manner *viz.* The eldeſt Son to have the 3d. part, and the other 4 Sons to have equal ſhares. What is the ſhare of each Son?

Operation.

l.	*s.*	*d.*		*l.*	
48	10	6		20	Burial expences
		5	Bills	164	Debts
242	12	6	A. of the B.	184	Total of out goings
500	-	-	Caſh		
742	12	6	Total		
184	-	-	Deduct		
3) 558	12	6	Free eſtate		
ſub. 186	4	2	Eldeſt ſon's ſhare		
4) 372	8	4	Remains to be divided amongſt the other ſons		
93	2	1	The ſhare of each of the other four ſons.		

REDUCTION.

REDUCTION teacheth to convert
The names of numbers moſt expert,
But the ſame value ſtill retain,
As underneath I ſhall explain.
It is compounded as you'll find
With all the former rules combin'd.

RULE.

When your *Reduction* muſt *deſcend*,
Obſerve the ſtrictures of a friend,
The given number multiply
With each denomination by,
Add to each product as you go,
The next inferior one below;
And when *Aſcending* you divide
Juſt by the ſame you multiply'd,
The numbers then revers'd appear,
And prove each other very clear.

EXAMPLE I.

In *l.* how many ſhillings, ſix-pences, three-pences, pence, half-pence and farthings?

l.	
1	
20	
20	ſhillings
2	
40	ſix-pences
2	
80	three-pences
3	
240	pence
2	
480	halfpence
2	
960	farthings

To work this example and all others of the kind, you muſt multiply by each next inferior denomination from the given one, to that ſought.

EXAM-

EXAMPLE 2.

How many farthings are there in 765l. ?

l.	
765	
20	
15300	shillings
12	
183600	pence
4	
734400	farthings

	l.	
Or thus	765	
	960	farthings in 1 pound
	45900	
	6885	
Anſwer	734400	the ſame as above.

EXAM-

EXAMPLE 3.

In 24l. 16s. 4d. ½ how many farthings?

l.	*s.*	*d.*	
24	16	4 ½	
20			
496			shillings
12			
5956			pence
4			
23826			farthings

In this example multiply as before but obſerve to take in the 16s. 4d. ½ in their proper places *i. e.* the 16 in the product of ſhillings, the 4 in the pence, and the ½ viz. 2 farthings in the farthings, or multiply 24 the number of pounds by 960 the farthings in 1l. and to the product add the farthings in 16s. 4d. ½ and the ſum will be the number of farthings ſought, as appears by the following

Operation.

l.			*s.*	*d.*
24			16	4 ½
960	farthings in 1l.		12	
1440			196	
216			4	
23040	farthings in	*l.* *s.* *d.*	786	
786		24 — —		
		0 16 4½		
23826	farthings in	24 16 4½		

EXAM-

EXAMPLE 4.

In 40 guineas how many shillings, pence and farthings?

40
21 s. = 1 guinea

40
80
---
840 shillings
12

10080 pence
4

40320 Farthings

EXAMPLE 5.

In 694l. 10s. How many crowns, shillings, groats and pence?

l.	*s.*	
694	10	(or 2 crowns)
4		
2778		crowns
5		
13890		shillings
3		
41670		groats
4		
166680		pence

Having worked these examples by *Reduction descending*, I shall next proceed to prove them by *Reduction ascending* or *Division*.

EXAM-

EXAMPLE 6.

In 960 farthings, how many halfpence, pence, three-pences, ſix-pences, ſhillings, and pounds?

2) 960

2) 480 halfpence

3) 240 pence

2) 80 three-pen.

2) 40 ſix-pences

2|0) 2|0 ſhillings

£ 1

EXAMPLE 7.

How many pounds are there in 734400 farthings?

4) 734400

12) 183600 pence

2|0) 15300 ſhill.

Anſw. 765 pounds

EXAMPLE. 8.

In 23825 farthings how many pounds?

4) 23826

12) 5956 ½

2|0) 49|6 4d.

Anſwer £. 24 16s. 4d. ½

EXAM-

EXAMPLE 9.

In 40320 farthings how man guineas?

4) 40320

12) 10080

21) 840 (40 Anſ.
84

0

EXAMPLE 10.

In 166680 pence, how many groats, ſhillings, crowns and pounds?

4) 166680

3) 41670 groats

5) 13890 ſhillings

4) 2778 crowns

694 2 - crowns = £694 10ſ.

Note. Theſe 5 laſt operations prove all the 5 firſt examples by beginning with the loweſt denomination, and dividing by the numbers they were multiplied by.

EXAMPLE

EXAMPLE. II.

Dick's Uncle being dead to his coffer he went,
To ſearch for the treaſure, it was his intent.
Unlocking the coffer he preſently found,
The ſum he had left him was two hundred pound,
Dick ſmiles on the hoard, as he's counting his chink,
And calls to *Ned Trotter* to bring him ſome drink.
Ned runs to the cellar and fetches a quart
Of humming ſtrong liquor to cheriſh his heart.
Dick drinks and carouſes reſolv'd to look big,
And roaring ſings *Roger de Calveley's Jigg*,
The ſight of his treaſure enliven'd his ſoul,
And made him cry out for a full flowing bowl,
Three fourths of the number of pounds in the cheſt,
Were good golden guineas and as to the reſt,
They were all half crown pieces, which pleaſed *Dick* well,
What number of each, with much eaſe you may tell,
Dick fills all his pockets, reſolv'd to look ſmart,
And no longer trudge after the plough or the cart,
But wear a big wig and forget what is paſt,
O'er his pipe and his bottle he'll take his repaſt,
As long as his old Uncle's money will laſt.

Firſt for $\frac{3}{4}$ of 200*l.* Multiply that ſum by 3 and divide the product by 4; or divide 200 by 4, and multiply the quotient by 3. and we have 150 guineas. thus.

200	4) 200	then 150
3	———	21
———	50	———
4) 600	3	150
———	———	300
150 guineas	150 guineas	———
———	———	3150 ſhill.

1ſt *i. e.* $\frac{3}{4}$ of the number 200 were guineas and not pounds.

	£.	
	200	
	20	
From	4000	shillings
Take	3150	
	850	remains
	12	
310)	10200	
Answer	340	half crowns

EXAMPLE II.

Suppose 6 ingots each in value 18 guineas, were carried to the mint to be coined into five and threepences. *Quere* the number?

£.	s.		s.	d.	
18	18		5	3	
	6		12		
113	8		63		divisor = 7 × 9
20					
2268					
12					
7)	27216				
9)	3888				
Answer	432				

Of COINS.

CASE 1.

To find the value of any Foreign Coins, in Engliſh Sterling. Multiply the given number by the loweſt Denomination of the price or value of 1. and divide the product by ſuch terms as ſhall bring out the value in pounds &c.

EXAMPLE 1.

In 486 Guilders of *Noremburgh* each 7*s*. 1*d*. how many pounds Sterling?

s.	*d*.	
7	1	486 guilders
12		85 pence in 1 guilder
85		2430
		3888
		12) 41310 pence in 486 guilders
		2|0) 3442|2 -6*d*.
		Anſwer 172 2 6*d*.

EXAMPLE 2.

In 320 three pound twelves, or *John's* pieces of *Portugal*, how many pounds Sterling?

£.	*s*.	
3	12	320
20		72
72		640
		2240
		2|0) 23040
		£ 1152 Anſwer.

Note. After this manner may any foreign coin be brought into *Engliſh* Sterling.

CASE

CASE 2.

When you are to reduce pounds Sterling into Foreign and Engliſh currency, reduce both the Sterling money and Foreign Coin into their loweſt denomination, divide the one by the other and the quotient will be the Anſwer.

EXAMPLE 1.

Admit a Merchant is to pay 496*l.* 12*s.* 3*d.* with Dollars of 4*s* 3*d.* each, how many muſt he procure for that purpoſe?

s.	*d.*		*l.*	*s.*	*d.*
4	3		496	12	3
12			20		
51		diviſor	9932		
			12		
			119187		

51) 119187 (2337 Anſwer
102
171
153
188
153
357
357
0

EXAMPLE 2.

How many Guineas, half-Guineas and quarter-Guineas of each an equal number will pay 91*l.* 17*s.* 6*d.*?

l.	*s.*	*d.*
1	1	–
–	10	6
–	5	3
1	16	9
20		
36		
12		
441	divisor	

l.	*s.*	*d.*
91	17	6
20		
1837		
12		
441) 22050 (50 Answer		
2205		
0		

In this Example the 3 several pieces are added together and reduced to pence for a divisor, by which the pence in the given sum are divided to obtain the number sought, and it may be easily proved that 50 of each make the given sum or quantity, for Illustration see the work.

l.	*s.*
1	1
	10
10	10
5	
52	10

s.	*d.*
10	6
	10
5	5 –
	5
26	5 –

l.	*s.*	*d.*
–	5	3
		10
2	12	6
		5
13	2	6

Guineas

Guineas	52	10	–
Half Guineas	26	5	–
Quarter Guineas	13	2	6
Proof	91	17	6

CASE 3.

When Coins of one country or nation are to be reduced to thoſe of another, divide one by the other in their loweſt terms and the quotient will be the Anſwer.

EXAMPLE I.

How many pieces of eight of *Mexico* each 4*s.* 5*d.* are in, or worth 240 cobs each 4*s.* 7*d.*

s.	*d.*		*s.*	*d.*		
4	5		4	7		240
12			12			55
53		divisor	55		multiplier	1200
						1200

53) 13200 (249
106
260
212
480
477
3

Anſw. 249 pieces and 3d. over.

EXAMPLE.

How many Moidores are equal to 99 Guineas?

99
21 shillings in a guinea
—
99
198
—
shill. in a moid. 27) 2079 (77 Answer.
189
—
189
189
—
0
—

COROLLARY.

Having in the preceding Example, sufficiently shewn the method whereby money is changed from one denomination to another, I shall now proceed to Reduction of weights measures &c.

TROY-

TROY WEIGHT.

EXAMPLE 1.

If a Silver Tankard weigh 1 lb. 8 oz. 14 dr, 21 grs. what is the content or weight thereof in grains?

lb.	oz.	dwt.	gr.
1	8	14	21
12			
20	ounces		
20			
414	penny-weights		
24			
1657			
830			
9957	grains		

EXAMPLE 2.

In 9957 grains how many penny-weights, ounces, and pounds?

4) 9957

6) 2489–1 grs.

2|0) 41|4–5 } 21

12) 20 14

1 8 oz.

Note. The grains in this example are divided by 4 and 6 (= 24) in order to abbreviate the work, and in all such cases *i. e.* when any divisor consists of such a number that 2 small numbers multiplied

Anſ. 1lb. 8 oz. 14dwt. 21grs.

EXAMPLE 3.

Suppoſe a Merchant buys 56 Ingots of Silver each weighing 21 oz. 12 dwt. and ſends them to a Silverſmith to be made into tankards, cups, ſalts and ſpoons, and of each an equal number, each tankard to weigh 19 oz. 18 dwt. each cup 14 oz. $\frac{1}{2}$, each ſalt 11 oz. $\frac{1}{4}$, and each ſpoon 2 oz. 4 dwt. How many of each ſort will they make?

		oz.	dwt.
The wt. of each	tank.	19	18
	cup	14	10
	ſalt	11	15
	ſpoon	2	4
		48	7
		20	
diviſor		967	

oz.	dwt.
21	12
20	
432	pen. w. in 1 In.
56	no. of Ingots
2592	
2160	
967) 24192	(25
1934	
4852	
4835	
17	

Anſwer 25 of each ſort and 17 dwt. over.

---

multiplied together will produce it, it will be much better to divide by thoſe numbers and proceed with the remainders (if any there be) as directed in *page* 118, wherein are ample directions for that purpoſe.

Apo-

Apothecaries Weight.

Example 1.

In 12 lb. how many ounces, drams, ſcruples, and grains?

lb.
12
12
---
144 ounces
8

1152 drams
3

3456 ſcruples
20

A. 69120 grains

Example 2.

How many ſcruples, drams, ounces and pounds, are there in 69120 grains?

2|0) 6912|0
---
3) 3456 ſcruples
---
8) 1152 drams
---
12) 144 ounces

Anſ. 12 pounds

Exam-

EXAMPLE 3.

In a medicinal compoſition of 25lb. 7oz. 3qrs. how many papers of powder may be made thereout each weighing 2 ſcr. 16 grs. allowing an ounce and half to be left in levigating and weighing, and admitting theſe powders were to be equally divided amongſt 175 perſons. How many muſt each one have?

	lb.	oz.	dr.
From the whole weight	25	7	6
Deduct the loſs		1	4
	25	6	2

ſcr.	grs.	
2	16	
20		
56	diviſor	

12

306 ounces

8

2450 drams

3

7350 ſcruples

20

175)

56) 147000 (2625 (15 A.

112 175

350 875

336 875

140 0

112 —

280

280

0

AVERDUPOISE WEIGHT.

EXAMPLE 1.

In 10 tons 12 c. 2 qrs. 14 lb. 10 oz. and 14 dr. How many drams?

t.	c.	qr.	lb.	oz.	dr.
10	12	2	14	10	14

20

212 hundreds

4

850 quarters

28

6804

1701

23814 pounds

16

142884

23815

381034 ounces

16

2286208

381035

Answ. 6096558 drams

EXAM

EXAMPLE 2.

In 6096558 drams, how many drams?

2) 6096558

8) 3048279 - 0 } dr. 14
4) 381034 - 7 }

4) 95258 - 2 } oz. 10
4) 23814 - 2 }

7) 5953 - 2 } lb. 14
4) 850 - 3 }

2|0) 21|2 - 2qrs.

(14grs.

Anſw. tons 10. 12c. 2qrs. 14lb. 10 oz.

EXAMPLE. 3.

Admit a *Weſt-India* planter hath rented a plantation 7 years at 750*l. per Annum*, which produced annually during that term 75 ton weight of ſugar, how many hogſheads each 7 *c.* ½ did the whole 7 years produce contain?

c.	qrs.	tons.	
7	2	75	
4		20	
30		1500	hundreds
		4	
	3|0	600|0	quarters
		200	hhds. in 1 y.
		7	no. of yrs.
Anſw.		1400	hhds.

Or thus

tons.	
75	
7	no. of yrs.
525	whole pro-
20	in tuns.
10500	hundreds
4	
3|0) 4200|0	quarters
Anſ. 1400	hhds. as before.

EXAMPLE 4.

In 1400 hogſheads of ſugar, each hogſhead weighing 7 c. $\frac{1}{2}$. How many pounds and tons?

c. qrs.
7 2
4

30 quarters
28

240
60

840 pounds in 1 hhd.
1400 no. of hhds.

336000
840

4) 1176000 pounds in all

7) 294000

4) 42000

2|0) 10500

525 tons

EXAMPLE 5.

Admit a grocer bought 9 hogſheads of ſugar, each 5c. 3qrs. 14lb. out of which ſuppoſe he has ſold 5c. 1qr. 16lb. ½. and orders the remainder to be made up into parcels of 26lb. each. How many will there be allowing 7lb. to be loſt in weighing them up?

	c.	qr.	lb.		c.	qrs.	lb.	
To	5	1	16 ½		5	3	14	
Add			7		4			
	5	1	23 ½		23			quarters
	4				28			
	21				188			
	28				47			
	171				658			pounds
	44				2			
	611				1316			half pounds in 1 hhd.
	2				9			no. of hhds.
	1223		From		11844			half pds. in the 9 hhds.
			Take		1223			quan. ſold
½ pds. in 1					10621			(204 parcels, and 6lb. ½ over
p. 52)					104			
					221			
					208			
				2)	13			half pounds
					lb. 6½			

Or thus,

	c.	qrs.	lb.
	5	3	14
no. of hhds.			9
The whole weight	52	3	14
deduct the quan. sold	5	1	16½
also that lost in weigh.			7
	5	1	23½
remains	47	1	18½

Note, 14lb. being half a quarter of a hundred, therefore in multiplying by 9 in this last operation, say 9 half quarters make 4 quarters and a half *viz*. 4 qrs. and 14lb. (which is more easy than multiplying 14 by 9 which makes 126lb. = 4 qrs. 14lb.) set down the 14 and proceed, to do which is so very easy, that any directions relating thereto wou'd be looked upon as prolixity only.

4
189 quarters
28
1520
379
5310 pounds
2
52) 10621 (204 par.
104
221
208
13
2) 13 half pds.
lb. 6½

Long Measure.

Example 1.

In 1 mile, how many poles, yards, feet, inches, and barley corns?

mile.	
1	
8	
8	furlongs
40	
320	poles
5½	
1600	
160	
1760	yards
3	
5280	feet.
12	
63360	inches
3	
190080	barley corns

Exam-

EXAMPLE 2.

How many inches, feet, yards, poles, furlongs and miles are there in 190080 barley corns?

3) 190080

12) 63360 inches

3) 5280 feet

1760 yards

2

half yards in 1 pole 11) 3520 half yards

40) 320 poles

8) 8 furlongs

1 mile

EXAMPLE 3.

The globe of our earth as fam'd *Norwood* has found,
Is twenty five thouſand and twenty miles round,
A mighty long journey for *Seamen* to take,
Such as *Dampier* Lord *Anſon* or Sir *Francis Drake*,
And ſuch bold adventurers who ſail on the Sea,
Who thouſands of miles muſt go out of their way,
What yards feet and inches, and barley corns too
Will ſurround the circumference preſently ſhew,

This was a fine queſtion in old *Cocker's* days
When the youths of the village contended for bays,
By ſolving ſuch queries, and anſwering fair,
What barley corns reach'd round th' terraqueous ſphere.

25020 miles
1760 yards in 1 mile

1501200
175140
25020

44035200 yards
3

132105600 feet
12

1585267200 inches
3

4755801600 barley corns

If it were only required to know the number of barley corns, the anſwer may be obtained by one multiplication, *viz.* by multiplying the number of miles by the barley corns in one mile, *ſee the work.*

25020 miles
190080 barley corns in 1 mile

2001600
22518000
25020

Anſwer 4755801600 the ſame as before

EXAM-

EXAMPLE 4.

Admit the *foremoſt* wheel of a Coach or other Carriage to be 3 ½ yards in circumference and the *hindmoſt* 5 ½ yards how many times will each turn round in 162 miles *viz.* between *London* and *Whitchurch* in *Shropſhire*.

The half yards in 162 miles divided ſeverally by the number of half yards in the circumference of each wheel quotes the number of times each will run round in that diſtance, as appears by the following

Operation.

The circum. of the { leſſer / greater } wheel is { 7 / 11 } half yards.

162 miles
1760 yards in 1 mile

9720
1134
162

285120 yards
2

7) 570240 half yards in 162 miles

81462 –6 *viz.* the leſſer wheel will turn round 81463 times, wanting half a yard.

Then for the greater wheel.

half yrds.
11) 570240

51840 times the greater wheel will turn round.

Cloth Measure.

Example 1.

In 7416 yards of cloth, how many quarters and nails?

yrds.
7416
4

29664 quarters
4

118656 nails

Example 2.

In 118656 nails, how many quarters and yards?

4) 118656
---
4) 29664 quarters

7416 yards

Example 3.

In 456¼ yards, how many ells *Engliſh*?

yrds. qr.
456 1
4
---
5) 1825

Anſw. 365

Example 4.

In 750 ells *Engliſh*, how many yards?

750
5
---
4) 3750 quarters

Anſ. 937½

Exam-

Example 5.

In 84 pieces of cloth each piece containing 30 yards how many suits of cloaths may be made thereout of 7 $\frac{1}{4}$ yards to the suit?

7 $\frac{1}{4}$ — 84 pieces
4 — 30 yards in 1 piece
29 — 2520 yards in all
4

29) 10080 (347 suits
87
138
116
220
203 (4$\frac{7}{29}$ yards over.
Answ. 347 suits and
4) 17 quarters
4$\frac{1}{4}$ yards

Land Measure.

Example 1.

To measure a neighbouring plain,
I took up my cross staff and chain.
Having found th' content of the whole,
Ninety acre two roods and a pole.
What roods and what perches were there
Be pleased to make to appear?

a.	r.	p.
90	2	1
4		
362	roods	
40		
14481	perches	

Example 2.

In 14481 perches how many acres?

40) 14481

4) 362 - 1

90 2r. 1p.

Answer 90 a. 2r. 1p.

WINE MEASURE.

EXAMPLE 1.

tons pipe hhd. gal. pts.

Reduce 8 1 1 14 6 to pints.

2

17 pipes

2

35 hogſheads

63

109

211

2219 gallons

8

17758 pints

EXAMPLE 2.

In 17758 pints how many tons?

8) 17758

7) 2219–6

9) 317 } 14

2) 35–2

2) 17–1

tons 8 1p. 1hhd. 14g. 6p.

Anſw. 8 ton 1 pipe 1 hhd. 14 gal. 6 pts.

EXAMPLE 3.

In 160 chests each 128 flasks of $3\frac{1}{2}$ pints each, how many hogsheads?

160 chests
128 flasks

1280
320
160

20480 flasks in all
$3\frac{1}{2}$ pints in 1 flask

61440
10240

8) 71680 pints in all

7) 8960 gallons

9) 1280-0 } 14
142-2 }

Answ. 142 hhds. 14 gal.

ALE

Ale and Beer Measure.

Example 1.

In 8 hogsheads how many pints?

8
51
---
408 gallons
8

3264 pints

Example 2.

Bring 3264 pints to hogsheads.

8) 3264
---- hhds.
51) 408 (8 Answ.
408

Dry Measure.

Example 1.

In 4 lasts, 3qrs. 2 bu. how many gallons?

last. qrs. bu.
4 3 2
10
---
43 qrs.
8
---
346 bushels
8

2768 gallons

Example 2.

Bring 2768 gallons into lasts.

8) 2768
---
8) 346
---
10) 43 - 2
---
4 - 3 - 2

Answ. 4 lasts 3 qrs. 2 bu.

TIME.

How many days, hours, minutes and ſeconds, ſince the birth of our LORD and SAVIOUR JESUS CHRIST, ſuppoſing it 1772 years ago, and allowing 365 days to a year?

1772
365
8860
10632
5316
646780
24
2587120
1293560
15522720
60
931363200
60
55881792000

EXAMPLE 2.

In 55881792000 ſeconds, how many years?

60) 55881792000
60) 931363200
4) 15522720
6) 3880680
yrs.
365) 646780(1772
365
2817
2555
2628
2555
730
730
0

Promiſcuous

Promiſcuous Queſtions.

Queſtion 1 By Mr. *Fenning.*

A rich Nobleman has 5 villages, in every village 3 ſtreets, in every ſtreet a dozen houſes, in every houſe 5 rooms, in every room 2 bureaus, in every bureau 12 drawers, in every drawer 4 bags, every bag valued at 150 guineas; which he is going to exchange for 3*l.* 12*s* pieces, how many muſt he receive?

£.	s.		
3	12	5	
20		3	
—		—	
72	diviſor	15	ſtreets
—	(=8 × 9)	12	
		—	
		180	houſ.
		5	
		—	
		900	rooms
		2	
		—	
		1800	burs.
		12	
		—	
		21600	draw.
		4	
		—	
		86400	bags
		150	
		—	
		12960000	guin.
		21	
		—	
		12960000	
		25920000	
		—	
		8) 272160000	ſhil-
		—	
		9) 34020000	
		—	
Anſwer		3780000	piec.
		—	

Queſtion 2. by Mr. *Vyſe.*

Suppoſe *London* was built 1108 years before the birth of our SAVIOUR, how many days is it ſince to Chriſtmas 1769 allowing *Julian* years of 365 days 6 hours?

To 1108
Add 1769
2877
365
1438
17262
8631
1050105
* 719 - 6 hours
Anſ. 1050824 days and (6 hours

* 6 hours being quarter of a natural day or 24 hours, therefore divide the given number of years by 4, and the quotient will be days.

4) 2877

719 days ¼ or 6 hou. over.

The RULE of THREE.

NOW to the *Golden Rule* we're come,
So Tyro haſte and learn a ſum;
View this extenſive Rule of art,
And learn proportion in each part.
This Rule, this *Golden Rule* of three,
Is excellent as you will ſee.
Three numbers given, great or ſmall,
It finds a fourth proportional,
To comprehend this uſeful art,
The following Rule learn well by heart.

A *General* RULE *for both* DIRECT, *and* INVERSE PROPORTION.

If any number great or leſs
Requires the ſame † for to expreſs;
Then in *Direct Proportion*, we
Bring out an anſwer ſpeedily;
But if a greater number ſhould
Require a leſs than what is told,
Or leſs a greater, than 'tis clear
Inverſe proportion muſt appear.
To ſtate your queſtion pray obſerve
You ne'er from truth and reaſon ſwerve;
Write down your terms, ſo as to name,
The firſt and third may be the ſame.
The ſecond and fourth exact agree;
Your numbers muſt reduced be

† That is, if *more* require *more* or *leſs* require *leſs*.

To

To what Denominations are
The loweſt, each to each compare.
Firſt in *Direct proportion* you,
Muſt multiply (two numbers true.)
The ſecond and third (of diff'rent name)
And by the firſt divide the ſame.
If your *Proportion* proves *Inverſe*
And greater ſums require a leſs.
Let the two firſt be multiply'd,
And by the third beſure divide.
And you will have an anſwer clear,
As quickly ſhall be made appear.

SCHOLIUM.

Before I ſhew how to work any Queſtions in this Rule it will be neceſſary to give the learner the following Inſtructions *i, e,* firſt obſerve that the firſt and fourth numbers are called *Extremes*, and the ſecond and third *Means*; the product of the *Extremes* is equal to the product of the *Means*. When the firſt term gives or requires the ſecond, we aſk what does the third term give or require alſo. If *more* be required it will be beſt (according to Mr. *Emerſon's* excellent method) to mark the *leſſer Extreme*; if *leſs* be required to mark the *greater Extreme* for a diviſor; then multiply the other two numbers together, and divide by this diviſor, the quotient is the anſwer, in the ſame denomination as the ſecond term. When there are remainders reduce them into lower denominations, and divide by the ſame diviſor.

EXAMPLE I.

As 4 is to 12, ſo is 18 to a certain number, or otherwiſe, as 4 is to 18, ſo is 12 to the ſame number, what is that number?

It is very evident that in this Example *more* is required, therefore mark the firſt extreme with an *Aſteriſm* for a diviſor, and proceed as before directed.

1ſt. As * 4 : 12 :: 18

12

4) 216

54

2d, As 4 : 18 :: 12

12

4) 216

54

COROLLARY.

Now it may be eaſily prov'd that the product of the two Extremes is equal to the product of the two means for 4 × 54 = 12 × 18 = 216.

LEMMA I.

When the ſecond term can be divided by the firſt, multiply that quotient into the third term and the product will be the anſwer.

To prove which take the laſt Example, 12 divided by 4 = 3. and 3 multiplied by 18 = 54.

EXAMPLE. 2.

As 6 is to 9, ſo is 12 to a certain number, what is the number?

* 6 : 9 :: 12

9

6) 108

Anſwer 18

LEMMA

LEMMA 2.

When the third term can be divided by the firſt, multiply that quotient by the ſecond term and the product will be the anſwer.

For $12 \div 6 = 2$ and $2 \times 9 = 18$ as above.

EXAMPLE. 3.

As 24 is to 8, ſo is 36 to a certain number, *Quere* the number?

* 24 : 8 :: 36

8

24) 288 (12 Anſwer

24

48

48

0

LEMMA 3.

When the firſt term can be divided by the ſecond, and the third term by that quote; the laſt quotient will be the anſwer.

For $24 \div 8 = 3$. and $36 \div 3 = 12$ the anſwer as above.

EXAM-

EXAMPLE 4.

As 48 is to 84, so is 8 to a certain number, *Quere* the number?

* 48 : 84 :: 8

8

48) 672 (14 Answer
48

192
192

0

LEMMA 4.

When the first term can be divided by the third, and the second by that quote, the last quotient will be the answer.

For $48 \div 8 = 6$, and $84 \div 6 = 14$ the answer as above.

COROLLARY.

Having shewn some excellent rules for ordering *proportional numbers*, I shall next proceed to shew their extensive use in trade, commerce, &c. But first I must observe to my ingenious reader, when any question can be easily wrought out by *Compound Multiplication* or *Division*, it will be more expeditiously done by thōse rules, as may be seen by the following example.

If

If 1 ounce of Silver cost 5s. 4d. ½, what will 132 ounces cost at that rate?

First by the *Rule of Three*.

oz.	s.	d.		oz.
* 1	: 5	4½	::	132
	12			
	64			
	4			
	258			
	132			
	516			
	774			
	258			
4)	34056			
12)	8514			
20)	709-6			

Anſ. £35 9s. 6d.

Now take the reverſe of this example which proves the work, and ſay If 132 ounces coſt 35l. 9s. 6d. What will 1 ounce coſt?

	£.	s.	d.	
* 132	: 35	9	6	:: 1
		20		
		709		
		12		
		8514		12)
132)		792		(64
		594		5s. 4d. ½
		528		
		66		
		4		
		264		
132)		264		(½
		264		
		0		

2d, By *Compound Multiplication*.

s.	d.	
5	4	½
	11	
2	19	1 ½
	12	

An. 35 9 6 as before

The ſame example wrought by *Compound Diviſion*.

£.	s.	d.
11) 35	9	6
12) 3	4	6

Anſwer 5 4½ the ſame as before

Theſe

Theſe examples plainly ſhew the extenſive uſe of *Compound Multiplication* and *Diviſion*, and how much preferable in ſome caſes they are to the *Rule of Three*, by ſolving queſtions in a far more conciſe manner, and therefore it is very neceſſary for all perſons to be thoroughly acquainted with thoſe moſt uſeful rules namely *Compound Multiplication* and *Diviſion*.

Example 6.

If 6 yards of cloth coſt 30s. What will 78 yards coſt?

yds.	s.	yds.
* 6	: 30 ::	78
		30
		6) 2340
		2|0) 39|0
		£ 19 10s.

Explanation.

It is very obvious that the demand lies upon 78 which therefore muſt be the *third number*, and as the *firſt number* muſt always be of the ſame name with the *third*, for that reaſon 6 muſt here be the *firſt number*, and then the other *number viz.* 30. (which is of the ſame name with the thing required) will remain and conſequently muſt be the *ſecond* or *middle number*, now the queſtion being thus ſtated and prepared for working, and as 78 yards will coſt more than 6 yards, it is manifeſt that 6 the *leſſer extreme* muſt be the diviſor, then by multiplying the *ſecond* and *third* numbers together, and dividing the product by the

firſt

firſt number or *leſſer extreme*, the quotient will be 390 ſhillings = 19l. 10s. whence the anſwer is 19l. 10s.

Example 7.

If a *Soldier's* pay be 6d. *per* day, what is that a year?

day	d.	days		
* 1	: 6 ::	365		
		. 6		
		12) 2190		
		2|0)	18|2	6
Anſw.		£9	2s.	6d.

Note. As multiplying or dividing by 1, neither augments the multiplicand, nor decreaſeth the dividend, therefore there is no occaſion to divide by the firſt term in this example, it being an unite.

Note. By reaſoning and a little conſideration, it may be eaſily known how to ſtate any queſtion for the *demanding ſum* or *quantity* muſt always be the *third number*, which muſt be of the ſame denomination as the *firſt*, whether money, weights, meaſures, or whatever elſe may occur in practice.

Exam-

EXAMPLE 8.

Admit a *gentleman* has a 1000l. *per annum*, how much may he expend daily, and lay up at the year's end 315l. 12s. 6d.?

£.	s.	d.
1000	—	—
315	12	6

* 365 : 684 7 6 :: 1

20

13687

12

12)

365) 164250 (450

1460

2|0)3|7-6d.

1825

1825 £1 17s. 6d. Answer

0

EXAMPLE 9.

If twelve pounds of bacon just cost me a crown,
For a flitch of fixscore † what must I pay down?

lb.	s.	lb.	
* 12	: 5	:: 120	† pounds

5

12) 600

2|0) 5|0

£2 10s. 6d. Answer

EXAMPLE 10.

If four ſtrike ‡ of corn, coſt a guinea not more,
Pray what muſt I give for one hundred and four? ‡.

b.	s.	b.	
4	: 21	:: 104	‡ Bulhels.
	21		
	104		
	208		
4)	2184		
20)	546		

Note. The proof of each example is only varying the operation as before taught in *page* 177

Anſwer £. 27 6s. 0d.

EXAMPLE 11.

Suppoſe a Bankrupt owes 1000l. and has in money, goods, and recoverable debts, 500l. 16s. 9d. ¾. Now ſuppoſe theſe things delivered to his Creditors, what do they get *per* pound?

£.	£.	s.	d.		£.
1000	: 500	16	9 ¾	::	1
	20				
	10016				
	12				
	120201				
	4				
1000)	480807				
4)	480 - 807 remains				
12)	120				

In this example though there is a large remainder, yet the part of a pound each one is to receive, can be no more than 10 ſhillings.

Anſwer 10 ſhillings

EXAMPLE 12.

A *Drover* came riding a man of good mettle,
Amongſt the *Welſh mountains* to buy up ſome *cattle*.
When the *Welſhmen* eſpy him they ſplutter and ſtare,
Saying " Bleſs you coot meaſter, come buy our fine ware,
" They're ſound wind and limb, and as fat as a pig,
" As plump as a Codlin, as ſleek as a ſnig;
" By their horns you may ſee, they're young and all that,
" Come bargain coot meaſter, you ſee they are fat."
Now th' *Drover* agrees for a ſcore of their cows,
Which fed in a meadow cloſe by the hay-mows.
For ſeventy-five guineas, the ſum was no more,
What each one was ſold for be pleas'd to explore?

Cows Guineas Cow.
20 : 75 :: 1

21

75

150

20) 157|5

20) 7|8 - 15 = 9*d.* for 15

12

Anſ. £ 3 18*s.* 9*d.*

20) 18|0

9

EXAMPLE 13.

Admit a Silverſmith bought as much Silver, as coſt him 146l. 14s. 8d. ½, at 5s. 3d. ½ *per* ounce. What quantity did he buy?

s.	d.		oz.		£.	s.	d.
5	3 ½	:	1	::	146	14	8 ½

12
63
2
127

20
2934
12
35216
2
12)
127) 70433 (554
635
693
635
583
508
75
20
dwts.
127) 1500 (11
127
230
127
103
24
412
206
grs.
127) 2472 (19
127
1202
1143
59

oz. dwt. grs.
lb. 46. 2 11. 19 Anſw.

EXAMPLE 14.

Suppose a person fails in trade;
And does compound to pay
Just twelve and six pence in the pound;
What was his debt I say?
When seven hundred all his store,
Of pounds was paid declare,
Young *Tyro*, and to *Phœbus* soar,
And meet *Apollo* there.

s.	*d.*	*l.*	*l.*
* 12	6	: 1	:: 700
12			20
150			14000
			12
			l.
150)			168000 (1120
			15 (Answ.
			18
			15
			30
			30
			0

Note. If the sum he owed *viz.* 1120*l.* had been given, and the rate he paid *per* £. to find the sum paid in all the question must be stated thus, as £1. : 12*s.* 6*d.* :: £1120 : £.700 = sum paid; and if the debt and sum paid were given to find the rate, it is as £.1120 : £700 :: £.1 : 12*s.* 6*d.* = rate required, which I leave for my learners exercise, see *page* 181.

EXAMPLE 15.

Bought 4 casks of raisins, each cask weighing 4c. 2qrs. 3lb. neat, what do they come to at 2*l.* 9*s.* 4*d.* ½ *per* hundred?

c.	£.	s.	d.		c.	qrs.	lb.
					4	2	3
							4
* 1.	2	9	$4\frac{1}{2}$	::	18	-	12

4 20 4

4 49 72
28 12 28

112 592 578
4 145

2370 2028
2028

18960
4740
47400

112) 4806360 (42913 4)
448 10728 - $\frac{1}{4}$ 12)
326
224 2|0) 89|4
1023 £44 14s. -d. $\frac{1}{4}$ Anſwer
1008
156
112
440
336
104

EXAMPLE 16.

Addreſſed to the young Ladies.

Fair *Sylvia* blooming as the roſe in *June*,
Oft met young *Damon* in the ſhady bow'rs,
Where warbling ſongſters chant a joyful tune,
To chear the pair, and bleſs their happy hours.
Oft, very oft, this lovely couple went
To pay a viſit to the ſilent grove,
And mingle kiſſes ſweet with true content,
To ſeal the vows of conſtancy and love.
But oft embarraſs'd were the lovely pair,
By a moſt rigid Father's ſtern decree,
Who wou'd not ſuffer any ſuitors there,
Sworn foe, to love alike and lenity.
Shou'd *Damon* near their ancient Caſtle come,
He ne'er muſt have admittance to his dear,
For th' Father's anſwer was "ſhe's not at home,
"And really Sir, you have no bus'neſs here."
Such rude behaviour long this couple bore,
With much anxiety and fretful pain,
'Till they agreed at laſt to bear no more,
But trip to *Scotland* o'er the chequer'd plain.
There to be link'd in *Hymen's* ſacred tye,
And crown their wiſhes by a ſpeedy flight;
Favour'd by night fair *Sylvia* forth did fly,
With *Damon* her enamour'd hearts delight.
Soon in the morn, ere *Phœbus* gilt the Weſt,
The Father was informed of the plot,
And to purſue the couple thought it beſt,
So in an inſtant he, on horſeback got.
Juſt thirty miles the lovers were before
The Father when he firſt began to ride,
Two miles he gain'd of them *per* hour or more,
But happily the marriage knot was ty'd
Before he did o'ertake the flying pair,
The rate they went was ſeven, miles an hour,
How many hours wou'd th' Father be, ye fair,
Ere he oertook them now to me explore?

By the queſtion the Father went 9 miles *per* hour for the other's 7, but they were 30 miles before him at the ſtart; whence 9—7 = 2 miles, which he gain'd *per* hour.

	miles	hour	miles
Then ſay *	2	: 1 ::	30
			1
			30
		2)	30
Anſwer			15 hrs.

Now it may be eaſily prov'd, that 15 hours was the time the father overtook the lovers in, for 15 × 9 = 15 × 7 + 30 = 135 the miles rode by both parties.

Example 17.

There is a lea or paſture which will feed 24 head of cattle 9 weeks, how long will it feed 36 head of cattle?

hd.		weeks		hd.
24	:	9	::	36 *
9				
36) 216 (6 weeks Anſwer				
216				
0				

It is very evident that this example is in *Reciprocal* or *Inverſe Proportion*, for 36 head of cattle will require *leſs time* to graze the paſture in than 24, therefore 36 the *greater extreme* muſt be the diviſor.

Exam-

Example 18.

Nine mowers agreed to mow down a mead,
In ten days their work they complete,
In how much time leſs, be pleas'd to expreſs
Wou'd fifteen men do the ſame feat.

m. days m.
9 : 10 :: 15 *

9

15) 90 (6 days
90

Now as 9 men (by the queſtion) requir'd 10 days to do the work in, and as 15 men can do it in 6, therefore they will do it in 4 days leſs, for 6 from 10 and there remains 4 the anſwer.

Example 19.

If 100l. in 12 months gain 5 Intereſt, what principal will gain as much in 9 months?

m. l. m.
12 : 100 :: 9 *

12

9) 1200

Anſwer *l.*133 6*s.* 8*d.*

Example 20.

A merry young ſpark, one night in the dark,
Came to me to borrow a crown;
Quoth he I will pay, in one year I ſay,
The caſh to you honeſtly down.
His words being true, I beg you will ſhew,
In *figures* as plain as you can,
How long he muſt lend, to requite me his friend,
Twelve ſhillings, and you are the man.

s.	days	s.
5	365	12
	5	

12) 1825

days 152 — 1 day

24

12) 24

hours 2

— Anſw. 152 days 2 hours

EXAMPLE 21.

If a board be eight inches in breadth, how long is
What length of the board will juſt make a foot ſquare?

in.	in.	in.
144	1	8
1		

8) 144

Anſwer 18 inches

EXAM-

EXAMPLE 22.

Admit a parlour be 30 yards round and 3 ½ yards high, how many yards of painted paper three-quarters of a yard wide, will be ſufficient to hang the ſame?

yds.		yds.		qrs.
3 ½	:	30	::	3
4		14		
14		120		
		30		
		3) 420		
		140 yards		

EXAMPLE 23.

If a cock in a veſſel nine hours does require,
To empty the ſame, then it is my deſire,
To know what cocks † more muſt be added thereto,
To empty it in twenty minutes? pray ſhew,

ho.		cocks		min.
9	:	1	::	20
60				
20) 540				

Now as 27 cocks will empty the veſſel in 20 minutes, conſequently 26 is the number of cocks required to be added to that which is given in the queſtion.

† Of equal capacity,

EXAM-

EXAMPLE 24. For the *Ladies*.

If a *Footman* from *Cheſter* to *London* ſhou'd run
In five days, eight hours long, between ſun and ſun;
Suppoſe when the days are twelve hours long again,
He goes the ſame journey quite over the plain;
What time will he do't in fair *Ladies* define?
And you ſhall wear *Laurels* be *ſcholars of mine*.

ho. day ho.
8 : 5 :: 12 *
8

12) 40 (3 days
36

4
8 length of the day in hours

12) 32 (2 hours
24

8
60 minutes in 1 hour

12) 480 (40 minutes
48

0

Anſwer 3 days, 2 hours, 40 minutes.

PROMIS-

PROMISCUOUS QUESTIONS.

Queſtion 1. By Mr. *George Fiſher.*

If that a rule of three foot long doth give five feet in ſhade,
And if a ſteeple ninety nine, how high in feet is't made?

f. s. f. l. f. s.
* 5 : 3 :: 99
3
5) 297
Anſwer 59⅖ feet

Queſtion 2. By the celebrated Mr. *John Tipper*, 1ſt author of the *Ladies Diary*, (being the firſt queſtion in that miſcellany for 1708, and the firſt that ever appear'd in that excellent work.)

Required the time of counting a million of money, at the rate of 100l *per* minute?

l. m. l.
* 100 : 1 :: 1000000
1
100) 10000|00
60) 1000|0
4) 166-40 min.
6) 41-2 hours
days 6-5

d. h. m.
Anſwer 6 22 40
22

Question 3. By the ſame, being the 3d. queſtion in that *Miſcellany*.

If thirteen tons of claret wine,
Coſt nineteen *Engliſh* pounds,
How many pints of the ſame wine,
Are worth a thouſand crowns.

Firſt reduce 13 tons to pints = 26208 pints.

£. pints £.

* 19 : 26208 :: 250 (= 1000 crowns)

250

1310400
52416

pints

19) 6552000 (344842 $\frac{12}{19}$, Anſwer
57

85
76

92
76

160
152

80
76

40
38

2 rem.

R Queſtion

Queſtion 4. By the ſame, being the 4th queſtion in the ſaid *Diary*.

If thirteen marks, and fourteen groats,
Buy fifteen loads of hay,
How many pounds with ſixteen crowns,
For ninety loads will pay?

Firſt by Reduction 13 marks + 14 groats = 178 ſhill.

loads		s.		loads		s.
* 15	:	178	::	90		16 crowns
		90				5
		ſhill.				
15)	16020	(1068	price of 90 loads			80 = ſhill.
	15	80	ſhill. in 16 crowns			—
	102	2|0) 98|8				
	90					
		£. 49	8s.	-d.	Anſwer	
	120					
	120					
	0					

Queſtion 5. By Mr. *Richard Carr*, ſee his Arithmetic, *p.* 52.

If 136 maſons build a fort in 28 days, to preſerve the Soldiers from the Enemy, but the General would have it built in 8 days, how many Men muſt be ſet to work?

	d.		m.		d.
Reciprocally	28	:	136	::	8 *
			28		
			1088		
			272		
		8)	3808		
		Anſwer	476	men	

Queſtion

Question 6. By Mr. *Hewet*, see his Arithmetic.

Two Ships set sail at one time from the same port, one sails 32 leagues *per* day north, and the other 45 leagues *per* day south, in how many days will they be 1942 leagues asunder?

```
        leagues   day        leagues
        * 77   :   1   ::    1942
   leagues                      1
Add { 32                      ----  days
    { 45                 77) 1942 (25 17/77
      --                      154
      77 distance in 1 day    ----
      --                       402
                               385
                               ---
                                17
                                --
```

Question 7. By Mr. *Leadbetter*, see his Mathematicians *Guide*.

A Fruiterer bought 2001 apples at three for a penny, and he also buys 2001 more at two for a penny, which he mingles together, and sells them out at 5 for two-pence; I demand whether he gain'd or lost by the bargain, and how much?

First find what 2001 apples come to at three a penny.

```
        ap.    d.        ap.
      * 3   :   1   ::   2001
                            1
                          ----
                     3)   2001
                          ----
                    12)   667
                          ----
                    2|0)  5|5 - 7d.
                          --
                          £2 15s. 7d.
```

Secondly find what 2001 come to at two a penny.

ap.	d.	ap.
* 2	: 1 ::	2001
		1
	2)	2001
	12)	1000 ½
	20)	83 - 4d.
		£.4 3s. 4d. ½

	£.	s.	d.
Add	4	3	4 ½
	2	15	7
	£.6	18	11 ½ the sum the apples cost.

Thirdly find what they were sold out for at 5 for 2d.

app.		d.		app.
				2001
				2001
* 5	:	2	::	4002
				2
			5)	8004
			12)	1600 ½
			20)	133 - 4d.
				£ 6 13s. 4d. ½

	£.	s.	d.	
From	6	18	11 ½	the sum the apples cost
Take	6	13	4 ½	for which they were sold
Remains -		5	6 ½	lost thereby

Question

Queſtion 8. By Mr. *Clare.*

Suppoſe the battering Ram of *Veſpaſian* weighed 100000 pounds, and was moved, let us admit, with ſuch a velocity, by ſtrength of hands, as to paſs through 20 feet in one ſecond of time, and this was found ſufficient to demoliſh the walls of *Jeruſalem*; with what velocity muſt a bullet that weighs but 30 pounds be moved, in order to do the ſame execution?

	lb.		feet		lb.
Reciprocally	100000	:	20	::	30 *

20

30) 2000000

66666 $\frac{20}{30}$ Anſwer

Queſtion 9. By Mr. *Benjamin Donn*, ſee his Arithmetic *page* 129.

Suppoſe that in a room where two men *A* and *B* are ſitting there is a fire, from which *A* is three feet, and *B* ſix feet diſtant, it is required to find how much hotter it is at *A*'s ſeat than at *B*'s?

To anſwer this queſtion it muſt firſt be philoſophically conſider'd and learnt, that the effects or degrees of light heat and attraction, are reciprocally proportional to the ſquares of their diſtances, from the center whence they are propagated.

	feet		feet
A's diſtance	3	*B*'s diſtance	6
	3		6
The ſqr. of *A*'s diſt.	9	The ſqr. of *B*'s diſt.	36

Reciprocally	36	:	1	::	9 *

1

9) 36

4 Anſwer

So that it is evident *A*'s place is 4 times as hot as *B*'s.

The Double Rule of Three,

Or Rule of Five Numbers.

COME *Tyro* haſte, as I'm alive,
You're mounted to the *Rule of Five*,
Where numbers five are truly given,
To find a ſixth be't odd or even;
Puſh forward then and you will ſee
'Tis call'd the *Double Rule of Three*
Becauſe two ſtatings there may be.

RULE.

Your ſecond term muſt always be,
(As in the *ſingle Rule of Three*)
The ſame denomination true,
As what is ſought appears to you;
Your terms of ſuppoſition write,
Each under each, the firſt in ſight,
And the demanding terms alſo,
You muſt put down the third in row.
Now reaſon as the *Rule of Three*,
And the diviſors you will ſee,
Which multiply together, and
A new diviſor there will ſtand.
Then th' other numbers multiply,
Each into each and you'll deſcry
Your dividend—ſo now you may
An anſwer find without delay.

EXAM-

EXAMPLE I.

If 100l. principal in 12 months gain 5l. intereſt, what will 180l. gain in 8 months?

Place the numbers as *per* rule *viz.* 5 for the middle term; and put the two terms of ſuppoſition 100l. and 12 months under each other in the firſt place, and then the terms of demand 180l. and 8 months muſt be put under each other in the third place, thus,

* 100l.——5l.——180l.
* 12 mo.————— 8 mo.

Now find the diviſors by uſing the ſecond term in common for both lines or ſtatings, for (as in the *Single Rule of Three* ſo here) if the *third term* requires *more* mark the *leſſer extreme*, if *leſs* the *greater* for a diviſor, which diviſors multiplied together make a new diviſor, as appears by the following

Operation.

100l.——5l.——180l.
12 mo————— 8 mo.

1200	diviſor	1440
		5
		12|00) 72|00
		£6. Anſwer

SCHOLIUM.

In ſtating queſtions in this rule remember that each *ſuppoſition* muſt be of the ſame name or denomination with its reſpective *demanding term*, as may be ſeen in

in the preceding example, wherein the *firſt ſuppoſition* being pounds, the *firſt demanding term* is pounds alſo, and the *other ſuppoſition* being months, its *oppoſite demanding term* is of the ſame name likewiſe.

Example 2.

If 30 buſhels of malt are ſufficient for a family of 6 perſons 12 months, how many buſhels will ſerve a family of 10 perſons 24 months or, two years?

* 6 per. —— 30 buſh. —— 10 per.
* 12 mo. —————— 24 mo.

72 diviſor	40	
	20	
	240	
	30	
—72)	7200	(100 buſhels
	72	(Anſwer
	00	

Example 3.

If forty hundred pound of beef,
Will ſerve four hundred *Tars*,
Juſt twenty days to fight the *French*,
Nor fearing death nor ſcars.
Then tell me *Tyro* if you pleaſe,
What pounds three hundred more
Muſt have to ſerve them thirty days,
All this you may explore.

* 400 Sai. ——— 4000 lb. ——— 300 Sai.
* 20 Days ——— 30 Days

8000 divisor

9000
4000

8|000) 36000|000

Answer 4500lb.

Example 4.

If 15 horses eat 60 bushels of oats in 20 days, how many bushels will 18 horses eat in 32 days?

* 15 ho. ——— 60 b. ——— 18 ho.
* 20 days ——— 32 days

300 divisor

36
54

576
60

3|00) 345|60

bush.

$115\frac{60}{300} = 115\frac{1}{5}$

Answer.

Exam-

EXAMPLE 5.

If the carriage of a ton weight, or 2240lb. from *Cheſter* to *London* which is 182 miles, at 1*d.* *per* lb. coſt 9*l.* 6*s.* 8*d.* what will the carriage of 3 ton weight coſt 240 miles?

* 2240lb.—9*l.* 6*s.* 8*d.*—6720lb. = 3 ton.
* 182 m.—20 ——— 240 m.

4480 / 186 / 268800
17920 / 12 / 13440
2240 / 2240 / 1612800
407680 divisor / 2240
64512000
3225600
3225600
12)
40768|0) 361267200|0 (8861
326144
2|0) 7318 - 5*d.*
351232
326144
£.36 18*s.* 5*d.* ½
250880
244608
62720
40768
219520
Answ. £.36 18*s.* 5*d.* ½ 4
40768|0) 878080 (½
81536
62720

EXAM-

EXAMPLE 6.

If 10 men in eight days mow 56 acres of graſs, in how many days will 500 acres be mowed by 30 men?

10 m.——8 d,——30 m. *
* 56 ac.——500 ac.

In this example it is very conſpicuous that the firſt line or ſtating is in *Reciprocal* or *Inverſe Proportion*, *more* requiring *leſs*, for if 10 men do the work in 8 days, 30 men will do it in leſs, therefore 30 the *greater extreme* of that ſtating muſt be the diviſor, and as in the other line or ſtating *more* requires *more*, *viz.* 500 acres require more days than 56 acres do, therefore this ſtating is in *Direct Proportion*, and conſequently 56 the *leſſer extreme* therein, muſt be the diviſor. *See the work.*

56 ac.
30 m.

1680 diviſor
---

500 ac.
10 m.

5000
8

1680) 40000 (23 days +
3360 (Anſwer

6400
5040

1360 remains

EXAM-

Example 7.

A *Col'nel* ſets five hundred men,
A trench to caſt with ſpeed;
Of juſt one thouſand yards in length,
Sev'n hours they take indeed
To do the ſame,—then in two hours,
What men employ'd muſt be,
To caſt twelve thouſand yards t' encamp,
His army tell to me.

* 1000 yds.——500 m.——12000 yds.
7 ho. —————— 2 ho. *

1000		12000
2		500
2000	diviſor	6000000
		7
	2|000)	42000|000
	Anſwer	21000 men.

Exam-

EXAMPLE 8.

If when the bushel of wheat costs 4*s*. 6*d*. the penny loaf weighs 10, oz. What will the sixpenny loaf weigh when wheat is 8*s*. 6*d*. the bushel?

s.	*d*.
4	6
12	

s.	*d*.
8	6
12	

54*d*. ——— 10, oz. ——— 102*d*. *

* 1*d*. ——————————— 6*d*.

102 divisor

54
10

540
6

102) 3240 (31 oz.
306

180
102

78
20

102) 1560 (15 dwt.
102

540
510 oz: dwt. grs.
— Anſ. 31-15 7 $\frac{6}{102}$
30
24

102) 720 (7gr.
714

6

SCHOLIUM.

The *Compound Rule of Three* is eaſily ſolved by the *Single Rule of Three* at ſeveral operations, by which I ſhall now work the 1ſt. example in *page* 199 which is as follows, *viz.* If 100l. principal in 12 months, gain 5l. Intereſt, what will 180l. gain in 8 months?

	£.		£.		£.	
First *	100	:	5	::	180	
					5	
					100) 900	(9£.
					900	
					0	

	mo.		£.		mo.	
Then *	12	:	9	::	8	
			8			
			12) 72			(6£. Anſwer
			72			
			0			

COROLLARY.

After the ſame manner may all the other examples be done at two ſtatings as they ſtand, and now having ſufficiently explained what is neceſſary in this rule, I ſhall give a few promiſcuous queſtions for exerciſe, and then proceed to that *expeditious rule* called *Practice*, ſo compendiouſly contrived for the ſpeedy caſting up of any ſort of goods or merchandize.

PRO-

PROMISCUOUS QUESTIONS.

Queſtion 1. By Mr. *Hill.*

If twenty *Dogs*, for thirty *groats*,
Go forty weeks to graſs,
How many *Hounds* for ſixty *crowns*,
May winter in that place?

Firſt from 52 (the weeks in a year) ſubtract 40, remains 12, 30 groats = 2 crowns, then

c.	dogs	c.
* 2	20	60
40 wks.		12 wks. *

12		60
2		40
24	diviſor	2400
		20
		dogs

24) 48000 (2000 Anſwer
48
000

Queſtion 2. By Mr. *Emerſon.*

If the carriage of 150 feet of wood, that weighs 3 ſtone a foot, comes to 3l. for 40 miles; how much will the carriage of 54 feet of free-ſtone, that weighs 8 ſtone a foot, coſt for 25 miles?

*	150 f.	3l.	54f.
*	3 ſt.		8ſt.
*	40 m.		25 m.

150		54
3		8
450		432
40		25
18000	divisor	2160
		864
		10800
		3
		32400 (1 *l.*
		18
		14400
		20
		288000 (16 *s.*
		18
		108
		108
Answ. *l.* 1 16 *s.*		0

Question 3. By Mr. *Hill.*

If 12 men build a wall 30 feet long, and 6 feet high, and 3 feet thick, in 15 days; in how many days will 60 men make a wall 300 feet long, 8 feet high, and 6 feet thick?

* 30 f. l. ——— 15 d. ——— 300 f. l.
* 6 f. h. ——— 8 f. h.
* 3 f. th. ——— 6 f. th.
12 m. ——— 60 m. *

30		300
6		15
180		1500
3		300
540		4500
60		8
32400	divisor	36000
		6
		216000
		12
		2592000

324|00) 2592|00 (80 days Answer
2592

0

Question 4. From *Palladium* 1760.

There are 8000 men in a garrison besieged, whose daily allowance is 24 ounces of bread for 7 weeks; but the governor finding the siege likely to continue a longer time, who can hold out 14 weeks at least, tho' he has by this time lost 1500 of his men; whereby he finds himself obliged to shorten that allowance of provisions; how much bread must each man's daily allowance be reduced to?

First 8000 — 1500 = 6500, then

7 w. ——— 24, oz. ——— 14 w. *

8000 m. ——————— 6500 m *

8000	6500
7	14
56000	26000
24	6500
224000	91000 divisor
112000	

91|000) 1344|000 (14 oz.
91

434
364

70000
20

91|000) 1400|000 (15 dwt.
91

490
455

35000

oz. dwt.
Answ. 14 15 $\frac{35000}{91000}$.

PRACTICE

PRACTICE.

THIS Rule, for quick diſpatch is plann'd,
Which, when you rightly underſtand,
With a conciſeneſs you may reach
The objects, more complex-ones teach;
'Tis a contraction you may ſee,
Of our fine *Golden Rule of Three*.
By parts we can diſcover fair,
The value of all Tradeſmen's ware;
And by leſs complicated rules,
Than ſome are taught in *Britiſh* Schools.

Tables of Aliquot Parts.

d.		*£.*		*s.*	*s.*	*d.*		*£.*
— 1/4	is	1/960	or	1/48	—	8	is	1/30
— 1/2	—	1/480	†	1/24	—	10	—	1/24
— 3/4	—	1/320	⊥	1/16	1	—	—	1/20
1	—	1/240	⊥	1/12	1	3	—	1/16
1 1/4	—	1/192	—	—	1	4	—	1/15
1 1/2	—	1/160	—	1/8	1	8	—	1/12
2	—	1/120	—	1/6	2	—	—	1/10
2 1/2	—	1/96	—	—	2	6	—	1/8
3	—	1/80	—	1/4	3	4	—	1/6
3 3/4	—	1/64	—	—	4	—	—	1/5
4	—	1/60	—	1/3	5	—	—	1/4
5	—	1/48	—	—	6	8	—	1/3
6	—	1/40	—	1/2	10	—	—	1/2
7 1/2	—	1/32	—	—				

s.	*d.*		*£.*
—	9	is	$\frac{3}{80}$
—	10		$\frac{5}{120}$
1	2		$\frac{7}{120}$
1	3		$\frac{5}{80}$
1	4		$\frac{2}{30}$
1	6		$\frac{3}{40}$
1	9		$\frac{7}{80}$
1	10		$\frac{11}{120}$
2	3		$\frac{9}{80}$
2	4		$\frac{7}{60}$
2	8		$\frac{4}{30}$ or $\frac{2}{15}$
2	9		$\frac{11}{80}$
3	—		$\frac{6}{40}$ or $\frac{3}{20}$
3	6		$\frac{7}{40}$
3	8		$\frac{11}{60}$
4	6		$\frac{9}{40}$
4	8		$\frac{7}{30}$
5	4		$\frac{8}{30}$ or $\frac{4}{15}$
5	6		$\frac{11}{40}$
7	4		$\frac{11}{30}$

s.	*d.*		*£.*
7	6	is	$\frac{3}{8}$
8	—		$\frac{2}{5}$
8	4		$\frac{5}{12}$
11	8		$\frac{7}{12}$
12	—		$\frac{3}{5}$
12	6		$\frac{5}{8}$
13	4		$\frac{2}{3}$
15	—		$\frac{3}{4}$
16	—		$\frac{4}{5}$
16	8		$\frac{5}{6}$
17	6		$\frac{7}{8}$
18	4		$\frac{11}{12}$

Tenths of 1 *£.*

2 *s.*	is	$\frac{1}{10}$	
4		$\frac{2}{10}$	or $\frac{1}{5}$
6		$\frac{3}{10}$	
8		$\frac{4}{10}$	or $\frac{2}{5}$
10		$\frac{5}{10}$	
12		$\frac{6}{10}$	or $\frac{3}{5}$
14		$\frac{7}{10}$	
16		$\frac{8}{10}$	or $\frac{4}{5}$
18		$\frac{9}{10}$	

d.		*s.*	
10 $\frac{1}{2}$	is	$\frac{7}{8}$	
10	—	$\frac{5}{6}$	
9	—	$\frac{3}{4}$	
8	—	$\frac{2}{3}$	
7 $\frac{1}{2}$	—	$\frac{5}{8}$	
4 $\frac{1}{2}$	—	$\frac{3}{8}$	
5 $\frac{1}{4}$	—	$\frac{1}{2}$	of $\frac{7}{8}$
3 $\frac{3}{4}$	—	$\frac{1}{2}$	of $\frac{5}{8}$
2 $\frac{1}{4}$	—	$\frac{1}{4}$	of $\frac{3}{8}$
$\frac{3}{4}$	—	$\frac{1}{2}$	of $\frac{1}{8}$
$\frac{1}{2}$	—	$\frac{1}{2}$	of $\frac{1}{12}$
$\frac{1}{4}$	—	$\frac{1}{4}$	of $\frac{1}{12}$

Having got perfectly well acquainted with the preceding tables, it will be found neceſſary to get by heart the following

RULE.

If th' given price of *one* is found
Part of a penny, ſhilling, pound,
Beſure divide the quantity
By ſuch a part whate'er it be.

EXAM-

EXAMPLES.

$\frac{1}{4}$	$\frac{1}{4}$	1468 lb. of caſt iron (at $\frac{1}{4}$ *per* lb.
1*d*	$\frac{1}{12}$	367
1*s*	2|0	3|0–7*d*.
		£.1–10*s*.–7*d*. Anſ.

The price being a farthing a pound, the given quantity is conſequently ſo many farthings, & a farthing being $\frac{1}{4}$ of a penny, and a penny the $\frac{1}{12}$ of a ſhilling, and a ſhilling the $\frac{1}{20}$ of a pnd. therefore the diviſors are 4, 12 and 20.

$\frac{1}{2}$	$\frac{1}{2}$	416 lb. at $\frac{1}{2}$ *per* lb.
1*d*	$\frac{1}{12}$	208
		17*s*.–4*d*. Anſwer

In this example the diviſors are 2 and 12, becauſe 2 halfpence make a penny, and 12 pence a ſhilling.

d.		
1 $\frac{1}{2}$	$\frac{1}{8}$	512 yards at $\frac{3}{4}$ *per* (yd.
$\frac{3}{4}$	$\frac{1}{2}$	64
	2|0	3|2
		£.1 12*s*. Anſw.

It is very evident that 512 yards at a ſhilling a yard come to thoſe many ſhillings, and 1*d*. $\frac{1}{2}$, being the $\frac{1}{8}$ of a ſhilling, and three farthings the $\frac{1}{2}$ of 1*d* $\frac{1}{2}$ therefore the quantity is divided by 8 and that quotient (or price at 1*d*. $\frac{1}{2}$) by 2 to obtain the anſwer.

1*d*.	$\frac{1}{12}$	8412 lb. at 1*d*. *per* lb.
	2|0	70|1
		£35–1*s*. Anſwer
1*d*.	$\frac{1}{12}$	5614 oz. at 1*d*. $\frac{1}{4}$ *per*
		467–10*d*.
$\frac{1}{4}$	$\frac{1}{4}$	116–11 $\frac{1}{2}$
	2|0	58|4–9–$\frac{1}{2}$
		£29–4*s*. 9*d*. $\frac{1}{2}$ Anſ.

EXAMPLES.

d.

1 ½ | ⅛ | 814 lb. at 1*d.* ¾ *per* lb.

¼ | ⅛ | 101 – 9*d.*
16 – 11 ½

2 | 0 | 11 | 8 8 ½

£5 18*s.* 8*d.* ½ Anſ.

Three halfpence being the ⅛ of a ſhilling, therefore 814 the given quantity, (which is eſteemed as ſo many ſhillings) is divided by 8, and a farthing being ⅙ of 1*d.* ½, that quotient (or price at 1*d.* ½) is divided by 6, the ſum of which quotients divided by 20 gives the anſwer.

2*d.* | ⅙ | 641 lb at 2*d. per* lb

2 | 0 | 10 | 6 – 10*d.*

£5 6*s.* 10*d.* Anſ.

2*d* | ⅙ | 868 oz. at 2*d.* ¼

¼ | ⅛ | 144 8*d.*
18 1

2 | 0 | 16 | 2 9

£8 2*s.* 9*d.* Anſw.

Two-pence being ⅙ of a ſhilling, and a farthing ⅛ of two-pence, therefore 868 the given quantity (which is eſteemed thoſe many ſhillings) is divided by 6, and that quotient by 8, which quotients added together and divided by 20 give the Anſwer.

3*d.* | ¼ | 1416 yards at 3*d.*

2 | 0 | 35 | 4

£17 14*s.* Anſwer

3*d.* | ¼ | 316 oz. at 3*d.* ½ *per* oz.

½ | ½ | 204
34

2 | 0 | 23 | 8

£11 18*s.* Anſwer

Here 816 the given quantity is divided by 4, the aliquot part that 3*d* is of a ſhilling, and that quotient by 6 the aliquot part a halfpenny is of 3*d.* for 6 halfpence make three-pence.

Examples.

4d. | 1/3 | 961 lb. at 4d. per (lb.
2|0 | 32|0 4d.
£16 0s. 4d. Anſw.

4d. | 1/3 | 5674 at 4d. 3/4
1/2 | 1/8 | 1891 4d.
1/4 | 1/2 | 236 5
| | 118 2 1/2
2|0 | 224|5 11 1/2
£112 5 11 1/2 Anſw.

In this example at 4d. 3/4 the diviſors are 3, 8 and 2, 4d. being the 1/3 of a ſhilling, a halfpenny the 1/8 of 4d. and a farthing the 1/2 of a halfpenny.

4d. | 1/3 | 814 ells at 5d. per (ell.
1 | 1/4 | 271 4d.
| | 67 10
2|0 | 33|9 2
£16 19s. 2d. Anſw.

4d. | 1/3 | 9160 yards at 5d. 1/4
1 | 1/4 | 3053 4d.
1/4 | | 763 4
| | 190 10
2|0 | 400|7 6
£200 7s. 6d. Anſ.

6d. | 1/2 | 1234 at 6d.
2|0 | 61|7
£30 17s. Anſwer

6 | | 1401 lb. at 6d. 1/2
| | 700 6d.
| | 58 4 1/2
2|0 | 75|8 10 1/2
£37 18s. 10d. 1/2

6d. | 1/2 | 124 ells at 7d. per (ell.
1 | 1/6 | 62
| | 10 4d.
2|0 | 7|2 4
£3 12s. 4d. Anſ.

EXAMPLES.

4*d*. | $\frac{1}{3}$ | 846 at 7*d*. $\frac{3}{4}$
3 | $\frac{1}{4}$ |
| | 282
$\frac{3}{4}$ | $\frac{1}{4}$ | 211 6*d*.
| | 52 10 $\frac{1}{2}$
2 | 0 | 54 | 6 4 $\frac{1}{2}$

£27 6*s*. 4*d*. $\frac{1}{2}$ Anſ.

In this example 846 the given quantity is divided by 3 and 4, the aliquot parts for 7*d*. and three farthings being $\frac{1}{4}$ of 3*d*. therefore the quotient of 4 (*viz*. the price at 3*d*.) is divided by 4, becauſe three farthings is the $\frac{1}{4}$ of three-pence

4*d*. | $\frac{1}{3}$ | 1464 at 8*d*.
4 | $\frac{1}{3}$ |
| | 488
| | 488
2 | 0 | 97 | 6

£48 16*s*. Anſw.

This example may be very expeditiouſly done, by taking the aliquot part of a pound, 8*d*. being the $\frac{1}{30}$th, ſo that by cutting off the cypher, and dividing by 3, the whole is done at once, but in this caſe the quantity is conſidered as pounds inſtead of ſhillings.

8*d*. | $\frac{1}{30}$ | 146 | 4 at 8*d*.

£48 16*s*. Anſw. as (before

6*d*. | $\frac{1}{2}$ | 567 at 8*d*. $\frac{1}{4}$
2 | $\frac{1}{3}$ | 283 6*d*.
$\frac{1}{4}$ | $\frac{1}{8}$ | 94 6
| | 11 9 $\frac{3}{4}$
2 | 0 | 38 | 9 9 $\frac{3}{4}$

£19 9*s*. 9*d*. $\frac{3}{4}$ Anſ.

In this laſt example the diviſors are 2, 3 and 8, 6*d*. being $\frac{1}{2}$ of a ſhilling, 2*d*, the $\frac{1}{3}$ of 6*d*, and a farthing the $\frac{1}{8}$ of 2*d*.

EXAMPLES.

6*d.*	½	942 yards at 9*d.*	
3	½	471	
		235 6*d.*	
2|0		70|6 6	
		£35 6*s.* 6*d.* Anſw.	
6*d.*	½	876 at 9*d.* ½	
3	½	438	
½	⅒	219	
		36 6*d.*	
2|0		69|3 6*d.*	
		£34 13*s.* 6*d.* Anſw.	
6*d*	½	5432 at 10*d.*	
4	⅓	2716	
		1810 8*d.*	
2|0		452|6 8*d.*	
		£226 6*s.* 8*d.* Anſ.	
6*d.*	½	1980 at 10*d.* ¾	
3	½	990	
1 ½	⅓	495	
¼	⅒	247 6*d.*	
		41 3	
2|0		177|3 9	
		£88 13*s.* 9*d.* Anſ.	

6*d.*	½	416 lb. at 11*d.* ¼	
4	⅓		(*per* lb.
		208	
1	¼	138 8*d.*	
¼	¼	34 8	
		8 8	
2|0		39|0 –	
		£19 10*s.* Anſwer	
1*s.*	1/20	56|8 yards at 12*d.*	
			(*per* yd.
		£28 8*s.* Anſwer	

CASE 1.

When the given price is more than a ſhilling, the given quantity ſtands for ſhillings; and for what the price exceeds a ſhilling or 12 pence, take parts as before; but if the whole price makes an even aliquot part of a pound, then divide by that part, if more convenient.

The following examples will make this clear and eaſy.

T

EXAMPLES.

3*d.* $\frac{1}{4}$ | 578 yards at 1*s.* 3*d.*
144 6*d.* (*per* yd.

2|0 | 72|2 6

£36 2*s.* 6*d.* Anſw.

Otherwiſe thus, by taking the aliquot part of a pound.

s d
1|3 $\frac{1}{16}$ | 578 ...

£36 2*s.* 6*d.* as before (fore

6*d.* $\frac{1}{2}$ | 4100 at 1*s.* 7*d.* $\frac{1}{2}$
1 $\frac{1}{2}$ $\frac{1}{4}$ | 2050
512 6*d.*

2|0 | 666|2 6*d.*

£333 2*s* 6*d.* Anſ.

Nineteen pence half-penny, (the price in this example) being no aliquot part of a pound therefore parts are taken for 7*d.* $\frac{1}{2}$, and added to the given quantity (being eſteemed ſhillings,) and the ſum divided by 20 gives the anſwer.

1|8 $\frac{1}{12}$ | 5671 at 1*s.* 8*d.*

£472 11*s.* 8*d.* Anſ.

In this example the diviſor is 12. 1*s.* 8*d.* being the $\frac{1}{12}$ of a pound.

6*d.* $\frac{1}{2}$ | 4162 yards at 1*s.*
4 $\frac{1}{3}$ | 2081 (11*d.* $\frac{3}{4}$
1 $\frac{1}{2}$ $\frac{1}{4}$ | 1387 4*d.*
$\frac{1}{4}$ $\frac{1}{6}$ | 520 3 = $\frac{1}{4}$ of 2081
86 8 $\frac{1}{2}$

2|0 | 823|7 3 $\frac{1}{2}$

£411 17*s.* 3*d.* $\frac{1}{2}$ A.

2*s.* $\frac{1}{10}$ | 516|8 ells at 2*s.* *p.*

£516 16*s.* (ell.

Otherwiſe thus,
5168
2

2|0 | 1033|6

£516 16*s.* as above

In the firſt operation of this example at 2*s.* you need only double the laſt figure in the quantity for ſhillings, the reſt are pounds.

EXAMPLES.

2|6 | 1/8 | 549 at 2s. 6d.

£68 12s. 6d, Anſ

5s. | 1/4 | 546 at 5s. 4d. 1/2

4d. | 1/60 | 136 10s.
1/2 | 1/480 | 9 2
1 2 9d.

£146 14s. 9d. Anſ.

Here the aliquot parts of a pound are taken, but it may be done otherwiſe, as under.

4d. | 1/3 | 546
5

2730
1/2 | 1/8 | 182
22 9d.

2|0 | 293|4 9d.

£146 14s. 9d. Anſ.

By this method you are only to multiply the quantity by the number of ſhillings in the price, and take parts for the remainder of the price as before taught. This method I prefer as much eaſier than the other.

s. d.
6|8 | 1/3 | 548 at 6s. 8d.

£182 13s. 4d. Anſ.

s.
10 | 1/2 | 618 C. at 10s. per C.

£309 Anſwer

s.
10 | 1/2 | 876 at 12s. 6d.

s. d.
2|6 | 1/4 | 438
109 10s.

£547 10s. Anſwer

s.
10 | 1/2 | 814 at 14s.
4 | 1/5 | 407
162 16s.

£569 16s. Anſwe

OBSERVATION.

When the price is any even number of ſhillings, you need only multiply the quantity by half the price, and double the firſt figure in the product for ſhillings. Take the laſt example *viz.*

Examples.

814 at 14s.
7

£569 16s. Answer

Remark.

This method being *very expeditious* when the price is any even number of shillings, therefore take another example when the multiplier consists of two places.

916 at 56s.
28

732 16s.
1832

£2564 16s. Answ.

Proof of this examp.

916
56

5496
4580

2|0) 512|96

£2564 16s.

CASE 2.

When you have a certain sum of money in pounds, and desire to know what quantity of goods may be bought therewith, at so many even shillings *per* lb. &c. you need only annex a cipher to the money, and divide by half the proposed price.

Example.

How many pounds of tea may be bought for £86, at 4s. *per* lb?

2) 860

Answ. 430 lb.

Example 2.

How many hogs can I buy for £56 at 16s. *per* hog?

8) 560

Answer 70 hogs.

EXAMPLES.

814 oxen at 16*l.*
16 (*per* ox.

4884
814

£13024 Anſwer

To work this and ſuch like examples, is no more than multiplying the quantity by the price, the *product* being the anſwer, but if there be any odd money, proceed as before directed by taking parts for the ſame.

s d
3|4 ½ 146 *C.* at 4*l.* 3*s.*
4 (4*d.*

584
24 6*s.* 8*d.*

£608 6*s.* 8*d.* Anſ.

4*d.* ⅓ 804 at 2*l.* —*s* 4*d.*
2

1608
13 8*s.*

£1621 8*s.* Anſwer

A S E 3.
hen the price is odd number of ıgs, multiply ıuantity by half greateſt even of ſhillings, le the firſt figure illings, and for dd ſhilling take the quantity.
at 15*s.*

4*s.*
16

Anſwer

ſheep at 19*s.* *p.*
(ſheep

12*s.*
14

6*s.* Anſwer

A S E 4.
the given price ch a fractional of a pound, ıg &c. that the *rator* or top fi- is more than an then multiply the

EXAMPLES.

the given quantity by ſuch *numerator* or top figure, and divide the product by the *denominator* or lower figure. A few examples will make this plain and eaſy.

s.

15 | $\frac{3}{4}$ 516 at 15*s.* *viz.* the
3 (laſt exam
(but one.
4 1548

£387 Anſwer

Note, 15*s.* being $\frac{3}{4}$ of a pound; the given quantity is multiplied by 3, and that product divided by 4, which gives the anſwer the ſame as before.—Again take an example on *page* 219 *viz.*

s. d.

12|6 | $\frac{5}{8}$ 876 at 12*s.* 6*d.*
5

8 4380

£547 10*s.* Anſw. as
(before

10*d* | $\frac{5}{6}$ 5432 at 10*d.* *
5

6 27160 * *ſee p.* 217

2|0 452|6—8*d.*

£226 6*s.* 8*d.* Anſ.

Note, after the ſame manner may any other example be done, when the price conſiſts of ſuch fractional parts as before mentioned.

CASE 5.

If the price is leſs than a pound or ſhilling by any ſingle aliquot part, you may take that aliquot part of the quantity, and ſubtract it there-from, and the remainder will be the anſwer.

To illuſtrate this take the laſt example but two *viz.*

$\frac{1}{4}$ 516 at 15*s.*
129 ſubtract

£387 Anſwer

EXAMPLES.

Again take another example on *p.* 222 *viz.*

5*s.*	$\frac{1}{4}$	896 at 12*s.* 6*d.*
s d		
2|6	$\frac{1}{2}$	219
		109 10*s.*
		328 10 ſubtract
		£547 10*s.* Anſwer

In this laſt example parts are taken for 7*s.* 6*d.* and the ſum of the quotes ſubtracted from the quantity leaves the anſwer.

Take the other example *viz.*

2*d*	$\frac{1}{6}$	5432 at 10*d.*
		905 4*d.*
2|0		452|6 8
		£226 6*s.* 8*d.* Anſw.

Note. After the ſame manner you may proceed with any other example of this kind.

CASE 6.

When the given quantity conſiſts of integers and fractional parts, multiply the price by the number of integers; and divide the odd quantity or fractional part into aliquot parts of the integer, or of each other, which being done add them all up together.

A TABLE *of Aliquot Parts of a C. Weight.*

lb.		*C.* wt.		lb.		
56	is	$\frac{1}{2}$	X	4	is	$\frac{1}{28}$
28	—	$\frac{1}{4}$	X	$3\frac{1}{2}$	—	$\frac{1}{32}$
16	—	$\frac{1}{7}$	X	2	—	$\frac{1}{56}$
14	—	$\frac{1}{8}$	X	$1\frac{3}{4}$	—	$\frac{1}{64}$
8	—	$\frac{1}{14}$	X	1	—	$\frac{1}{112}$
7	—	$\frac{1}{16}$	X			

Note. Aliquot parts of moſt other things being eaſily found, it would be needleſs to ſay any thing more in this place, concerning them.

EXAMPLES.

C.	*qrs.*		*£.*	*s.*	
8	1	at at	1	16	*per C.*

		£.	*s.*	
qr	¼	1	16	In this example the price
1			8	is multiplied by 8, and di-
		14	8	vided by 4, the aliquot part
		0	9	for one quarter.
		*£*14	17	Anſwer

16 *C.* 2 *qrs.* 8 *lb.* at *£*2 4*s.* 1*d. per C.* weight.

		£.	*s.*	*d.*	
qrs	½	2	4	1	
2				8	
		17	12	8	the price 8 *C.*
				2	

						C.	*qrs.*	*lb.*
lb.		35	5	4		16	–	–
8	¼	1	2	0½	the price of	–	2	–
	⅐	–	3	1¾		–	–	8
		*£*36	10	6¼	the price of	16	2	8

Examples.

249 *C.* 3 *qrs.* 10 *lb.* ½ at £3 2*s.* 8*d.* *per C.*

3

747

2*d.*	⅛	31	2	6
	1/15	2	1	6

£*1 11 4 price of ½ C.

					C.	*qrs.*	*lb.*
qr.		780	4	—	249	—	—
1		* 1	11	4	—	2	—
7*lb*	½	—	15	8	—	1	—
3½*lb*	¼	—	3	11	—	—	7
	½	—	1	11½	—	—	3½

£782 16 10½ the price of 249 3 10½

3 *qrs.* 16 *lb.* ½ at £6 12*s.* *per C.*

qrs		£.	*s.*	
2	½	6	12	

					qrs.	*lb.*
1	½	3	6		2	—
14*lb*	½	1	13		1	—
2	1/7	—	16	6	—	14
½	¼	—	2	4¼	—	2
		—	—	7	—	— ½

£5 18 5¼ the price of 3 16 ½

EXAMPLES.

lb. oz. dwt. £. s.
20 1 6 at 4 10 *per* lb.

oz. 1 | 1/12
£. s.
4 10
10

45
2

90 — —
dw 4 | 1/5 — 7 6
2 | 1/2 — 1 6
— — 9

lb. oz. dwt.
20 — —
— 1 —
— — 4
— — 2

£20 9 9 the price of 20 1 6

£. s. d.
6 yds. 2 qrs. 2 nls. at 1 2 6 *per* yard.

qr. 2 | 1/2
£. s. d.
1 2 6
6

6 15 —
nl. 2 | 1/4 — 11 3
— 2 9¾

yds. qrs. nls.
6 — —
— 2 —
— — 2

£7 9 0¾ the price of 6 2 2

EXAMPLES.

SCHOLIUM.

According to the foregoing reaſoning and method of calculation, any thing may be done that may occur in *Practice;* and to conclude this excellent compendium of arithmetic called *Practice,* I ſhall here preſent my readers with ſome articles therein, lately received from my generous and worthy friend Mr. *P. Antrobus,* Maſter of *Middlewich* Grammar School *Cheſhire,* they are as follow.

A new eaſy and coneiſe method of ſolving any queſtion in *Practice,* whether it relates to weight, meaſure, or time; by reducing the weight meaſure or time into money, and finding the price at two ſhillings, whatever the given price is.

RULE.

Double the right hand figure of the given number (whoſe price is ſought) for ſhillings, the reſt are pounds. Admit 364 yards of cloth be ſold for 2*s.* *per* yard; here the right hand figure 4 being doubled is 8, and the remainder 36, I account *£* 36, therefore the amount of 364 yards at 2*s.* *per* yard, is *£* 36 8*s.* Now if one yard coſt 2*s*, a quarter will coſt 6*d*, therefore 364 $\frac{3}{4}$ yards at 2*s.* *per* yard, will coſt *£* 36 9*s.* 6*d.* and if one quarter coſt 6*d.* then half a quarter will coſt 3*d*, &c. Whence 186 *C.* 3 *qrs.* 14 *lb.* at 2*s.* *per C.* will coſt *£* 18 13*s.* 9*d.* and in like manner for any other caſe whether weight meaſure or time.

Hence when you have converted your weight meaſure or time into money, multiply the money ſo converted by half the pounds and ſhillings reduced into ſhillings, and take parts of 2*s.* for the pence &c as before, add all together and you have the anſwer.

But to find more eaſily the price of any number of pounds at 2*s* *per C* account the given pounds as ſo many farthings, and ſubtract the 7th, part thereof from the ſaid farthings, the remainder will be the price in farthings.

EXAMPLE.

EXAMPLE.

What coſt 24 lb. at 2*s*. *per C.*

7) 24

ſubtract 3 $\frac{3}{7}$

Anſwer 20 $\frac{4}{7}$ farthings

Thus 256 *C.* 3 qrs. 24 lb. at 2*s*. *per C.* comes to £25 13*s*. 11*d*.–$\frac{4}{7}$

EXAMPLE 2.

What coſt 326 lb. at $\frac{3}{4}$ *per* pound?

		£.	s.
6*d*.	$\frac{1}{4}$	32	12
$\frac{3}{4}$	$\frac{1}{8}$	8	3
		1 –	$4\frac{1}{2}$

Here you ſee doubling the laſt figure gives the price at 2*s*. Then taking any even part of 2*s*. as here, 6*d*. is $\frac{1}{4}$ gives £8 3*s*. the price at 6*d*. then $\frac{3}{4}$ being $\frac{1}{8}$ of 6*d*. I take the $\frac{1}{8}$ thereof and it gives the anſwer, and ſo in the other examples following.

EXAMPLE 3.

What coſt 274 yards at 5*d*. *per* yard?

4*d*.	$\frac{1}{6}$	27	8	
1*d*.	$\frac{1}{4}$	4	11	4
		1	2	10
Anſ.		5	14	2

EXAMPLE 4.

What come 36 days wages to at 2*s*. 2*d*. *per* day?

36 days wages are equal to £3 12*s*. at 2*s*. *per* day.

$\frac{1}{12}$ for 2*d*. is 6

Anſwer 3 18

EXAMPLE

EXAMPLE 5.

What coſt 171 lb. 2 oz. 18 dwt. at £5 8s. *per* pound?

lb.	oz.	dwt.		£.	s.	d.				£.	s.
171	2	18	equal to	17	2	5	$\frac{2}{4}$	$\frac{1}{3}$	at 2s *per lb.*	5	8

54

68 9 11 $-\frac{4}{5}$

856 4 2

924 14 1 $\frac{4}{5}$ Anſwer

20

2) 108

12) 50. 54

2|0) 12|4-2

6 4 2

EXAMPLE 6.

What coſt 171 *C.* 1 *qr.* 4 *lb.* at £3 1s. 4d. *per C.* weight Averdupoiſe?

C.	*qr.*	*lb.*		£.	s.	d.				
171	1	4	equal to	17	2	6	$\frac{3}{4}$	$\frac{3}{7}$	at 2s. *per* C.	

30 $\frac{1}{2}$

£.	s.						
3	1	5	13	17	1	$\frac{1}{2}\frac{6}{7}$	= 30 times the price at 2s.
20			8	11	3	$\frac{1}{4}\frac{5}{7}$	= $\frac{1}{2}$ of
			2	17	1	$-\frac{4}{7}$	= $\frac{1}{6}$

2) 61

Anſw. 525 5 6 $\frac{1}{4}\frac{1}{7}$

30 $\frac{1}{2}$ No. of 2s.

(in £3 1s.

7) 20

4) 22 $\frac{6}{7}$

12) 85 $\frac{1}{2}$

2|0) 7|7 1

£3 17 1 $\frac{1}{2}\frac{6}{7}$

Note. That the learner may not be unacquainted with the method of working theſe examples, I ſhall add the following EXPLANATION.

The meaning of this diviſion with the work in the operation is thus performed.

First 30 × $\frac{3}{4}$ = $\frac{90}{4}$ = 12 $\frac{6}{4}$ farthings, then 30 × $\frac{3}{4}$ + 12 = $\frac{102}{4}$ farthings = 25*d.* $\frac{1}{2}$, and 30 × 6 + 25*d.* = $\frac{205}{12}$*d.* = 17*s.* 1*d.* then 30 × 2*s.* = £3, whence we have £3 17*s.* 1*d.* $\frac{1}{2}$ $\frac{6}{7}$. Laſtly 17 × 30 = 510, which add to £3 17*s.* 1*d.* $\frac{1}{2}$ $\frac{6}{7}$ makes £513 17*s.* 1*d.* $\frac{1}{2}$ $\frac{6}{7}$, the next line is found by taking $\frac{1}{2}$ of the price at 2*s*, for the $\frac{1}{2}$, and laſt of all $\frac{1}{8}$ of the price of 2*s.* for the 4*d.* which ſums being all added together make the anſwer as before.

Example 7.

What is the yearly Rent of 107 acres 2 roods at 45*s. per* aere?

a.	rds.		£.	s.	
107	2	equal to	10	15	at 2*s per* acre.
				22 $\frac{1}{2}$	half value
			21	10	
			21 5	—	2|0) 10|0
			5	7 6	5
		Anſwer	£241	17 6	

Example 8.

What coſt 107 barrels 9 gallons of ale or beer, at 31*s. per* barrel?

bar.	g.		£.	s.	d.		
107	9	=	10	14	6	$\frac{1}{4}$ $\frac{7}{17}$	2) 21*s.*
					15 $\frac{1}{2}$		15 $\frac{1}{2}$
53	12		7			$\frac{3}{4}$ $\frac{1}{17}$	17) 70
107	5		3			$\frac{1}{2}$ $\frac{2}{17}$	4) 14 $\frac{2}{17}$
5	7		3			$\frac{12}{17}$	12) 63 $\frac{1}{2}$
		Anſwer	£166	5	2	$\frac{1}{4}$ $\frac{15}{17}$	2|0) 14|5 3
							7-5-3 $\frac{1}{2}$

Note. More examples might be added but theſe are ſufficient to ſhew the method.

TARE

TARE *and* TRET.

SIX terms are in this rule combin'd
To be obſerved as you'll find;
Groſs, *Tare*, *Tret*, *Suttle*, *Cloff*, *Neat-weight*,
Which muſt be us'd to work it right.

1. *Groſs*, is the whole weight of any commodity be what it will, with the hogſhead, cheſt &c. that contains it.

2. *Tare* is an allowance made by the *King* to the *Importer*; or by the *Merchant* to the *Buyer* for the weight of the bag, caſk, cheſt, wrapper &c. in which any goods are packed up.—In a book intitled *The Book of Rates*, there is a table in which ſeveral ſorts of goods have their Tares aſcertained.

3. *Tret* is an allowance generally made by the *Merchants* of *London* to their *Tradeſmen*, &c. for waſte and duſt in *Tobacco*, *Spices*, *Drugs*, &c. being 4 ℔. in 104 ℔. *viz.* $\frac{1}{26}$ part of the whole, after the Tare is deducted.

4. *Suttle*, is the weight of the goods when only the Tare is taken out, and not the Tret.

5. *Cloff* is an allowance made alſo by the *Citizens* of *London*, for the turn of the ſcale, *viz.* 2 ℔. for every 3 *C.* weight, or as ſome ſay for 3 *C.* 1 qr. 8 ℔.

6. *Neat-weight* is the weight of any goods, when all allowances are deducted.

First. *When the* Neat-weight *of any goods is required, and only* Tare *allowed; obſerve the following*

RULE.

From the *Groſs weight* deduct the *Tare*,
And the *Neat weight* will then appear.

Example 1.

If I buy 114 *C.* 1 *qr.* 20 *lb.* of Tobacco or any other goods, and am allow'd 1 *C.* 2 *qrs.* 4 *lb.* Tare, what is the neat weight?

	C.	*qr.*	*lb.*
From the groſs	114	1	20
Deduct the tare	1	2	4
Remains	112	3	16 neat

Example 2.

In 8 bags of hops each weighing groſs 3 *C.* 2 *qrs.* 15 *lb.* tare 12 *lb. per* bag. How much neat weight?

	lb.		*C.*	*qrs.*	*lb.*	
Tare *per* bag	12		3	2	15	
Number of bags	8				8	
	—	*qrs.*				
28)	96	(3	From	29	8	groſs
	84		Take	3	12	tare
	12 *lb.*		Anſw.	28	24	

Example 3.

In 310 *C.* 1 *qr.* 16 *lb.* groſs, tare 16 *lb. per C.* What is the neat?

lb.	*C.*	*qr.*	*lb.*
16 is 7)	310	1	16
Tare	44	1	10 $\frac{1}{4}$
Anſw.	266	1	10 $\frac{3}{4}$

Note. In dividing by 7 there remains 2 *lb. viz.* 8 *qrs.* which being divided by 7, quotes a quarter and 1 remains, and which may be rejected as inconſiderable.

Exam-

EXAMPLE 4.

What is the neat weight of 4 casks of Raisins, each cask weighing,

	C.	qrs.	lb.	
No. 1	2	2	14	
2	3	1	10	lb.
3	2	3	16	Tare 12 *per C.*
4	1	3	24	how much neat?

lb.				
14 is $\frac{1}{8}$)	10	3	8	the whole grofs
2 is $\frac{1}{7}$)	1	1	$11\frac{1}{7}$	
Deduct	–	–	$21\frac{1}{2}$	the tare at 14 2 12 *per C.*
Remains	1	–	18	

From the whole grofs	10	3	8
Deduct the tare	1	–	18
Remains neat	9	2	18

2d. When Tret *is allowed with* Tare, *obſerve the following*

RULE:

From the whole *Groſs* deduct the *Tare*,
And th' *Suttle weight* will then appear,
Which weight by twenty-ſix divide;
The quote's the *Tret*, and then beſide
Deduct it from the *Suttle weight*,
And the remainder is the *Neat*.

EXAMPLE I.

In 12 *C.* 1 *qr.* 18 *lb.* groſs, tare 40 *lb.* tret 4 *lb.* *per* 104. How much neat weight?

C.	*qr.*	*lb.*
12	1	18
4		
49		
28		
400		
99		
From the groſs 1390		
Deduct the tare 40		
26) 1350 (51¾ Tret		
130		
50		
26		
24		
4		
26) 96 (¾		
78		
18		

EXAM-

From Suttle 1350
Deduct Tret $51\frac{3}{4}$

28 { 4) $1298\frac{1}{4}$; 7) 324–2 } lb. 10 ; 4) 46–2

Answer *C.* 11–2–10 $\frac{1}{4}$

Or thus,

	C.	*qr.*	*lb.*
From grofs	12	1	18
Deduct 40*lb.* the tare)	–	1	12
	26) 12	–	6 fut.
Deduct	–	1	$23\frac{3}{4}$ tr.
Remains	11	2	$10\frac{1}{4}$ nt.

EXAMPLE 2.

In 121 *C.* 2 *qr.* 4*lb.* grofs, tare 8 *lb. per C.* tret 4 *lb. per* 104. What is the neat weight?

lb.	*C.*	*qrs.*	*lb.*	
16 is $\frac{1}{7}$)	121	2	4	grofs
8 is $\frac{1}{2}$)	17	1	$12\frac{1}{2}$	the tare at 16 lb. per *C.*
From grofs deduct	8	2	$20\frac{1}{4}$	the tare at 8 lb. per *C.*
26)	112	3	$11\frac{3}{4}$	futtle
Deduct	4	1	10	tret
Answer	108	2	$1\frac{3}{4}$	neat

3d. When Cloff *is allowed with* Tare *obſerve the following*

RULE.

Suttle and *Tret*,—found as before,
Another Suttle will make more,
From which deduct the *Cloff* beſure,
And the *Neat weight* you will procure.

EXAM-

Example 1.

In 14 *C.* 2 *qrs.* 10 *lb.* groſs. tare 2 *C.* 3 *qrs.* 14 *lb.* tret 4 *lb. per* 104 *lb.* and cloff 2 *lb.* for 3 *C.* What is the neat weight?

From the groſs	14	2	10
Take the tare	2	3	14
	26) 11	2	24
Deduct the tret	—	1	$22\frac{3}{4}$
2d. ſuttle	11	1	$1\frac{3}{4}$
Deduct the cloff	—	—	7
Remains neat	11	—	$22\frac{1}{4}$

Cloff is found by multiplying the 2d. ſuttle by 2, and dividing that product by 3, or divide the 2d. ſuttle by 3 the quotient will be double pounds in the cloff, or otherwiſe it may be found by dividing the pounds in the 2d ſuttle by 168, *two pounds* being the 168th part of 3 *C.* weight.

C.		*C.*
11		3) 11
2		
3) 22		*lb.* $3\frac{2}{3}$ double *lbs.* = $7\frac{1}{3}$ as before
lb. $7\frac{1}{3}$ * Cloff		

Or 1232 the pounds in 11 *C.* (the 2d. ſuttle) divided by 168 quotes $7\frac{56}{168} = 7\frac{1}{3}$ as above.

Example 2.

What is the neat weight of 2 hogſheads of tobacco weighing

	C.	*qrs.*	*lb.*		
No. 1	5	3	10	groſs	Tare 7 *lb. per C.* tret 4 *lb. per* 104, and cloff 2 *lb. per C.* weight.
2	4	1	12		
wh. groſs	10	—	22		

* What odd weight remains in finding *Cloff* is inconſiderable and need not be noticed.

	C.	qrs.	lb.		
7 is $\frac{1}{16}$)	10	–	22	groſs	
Deduct	–	2	$15\frac{1}{4}$	tare	
26)	9	2	$6\frac{3}{4}$		C.
Deduct	–	1	13	tret	9
					2
	9	–	$21\frac{3}{4}$	2d. ſuttle	—
Deduct	–	–	6	cloff	3) 18
Neat	9	–	$15\frac{3}{4}$		6 cloff.

SCHOLIUM.

I hope by this time I have given ſufficient examples to make my ingenious readers thoroughly acquainted with *Tare* and *Tret*, and ſhall now proceed to Bills of Parcels and Book Debts.

Bills of Parcels and Book Debts.

Litchfield 21ſt, *Feb.* 1772.

Mrs. *Jane Podmore*

Bought of *Humphrey Hoſier*.

					£.	s.	d.
8	Pair of Silk Stockings at	10s.	6d.	*per* pair	4	4	–
5	—— Worſted ditto	3	4	–	–	16	8
4	—— Thread –	5	–	–	1	–	–
16	—— Yarn –	1	10	–	1	9	4
18	—— Cotton –	4	6	–	4	1	–
9	—— Women's Silk Gloves	4	3	–	1	18	3
20	Yards of Flannel –	1	6	*per* yd	1	10	–
					£14	19	3

The Honourable Lady *Pink*,

To *Anne Milliner* Dr.

1772 *London*

		s.	d.	£	s.	d.
Jan. 12:	To fine Lace 12 yds at 10 4 *p.* yd			6	4	—
	Flower'd Ribbon, 10½ at 2*s* 6*d*			1	6	3
14:	Sarcenet Hoods 6¾ at 4*s* —			1	7	—
24:	Kid Gloves 8 pair at 2*s* 1*d p.* pair			—	16	8
Feb. 1:	Lambs ditto 2 doz. at 12*s per* doz.			1	4	—
Mar. 18:	*India* Fans 6 doz. at 4*s* 1*d*			1	4	6
				£12	2	5

Whitchurch 4th, *February* 1772.

Peter Paywell Esq.

Bought of *John Woollendraper*.

			£	s.	d.
10 yards of fine broad cloth	at 12*s* 6*d per* yd.		6	5	—
6 — superfine ditto	at 17*s* 1*d* —		5	2	6
14 — drugget ¾ wide	at 5*s* 4*d*		3	14	8
18 — yard wide	— 4*s* 1*d*		3	13	6
10 — serge —	at 3*s* —		1	10	—
40 — Shalloon —	at 1*s* 6*d*		3	—	—
		£	23	5	8

Whitchurch 11th, of *March* 1772.

Mrs. *Townley*

Bought of *Edmund Linendraper*.

			£	s.	d.
30 Ells of dowlas at 1*s* 6*d per* ell	—		2	5	—
60 — diaper at 1*s* 6*d* ½	—		4	12	6
12½ yards *Irish* cloth at 3*s* 2*d per* yard			1	19	7
16 — of muslin at 8*s*	—		6	8	—
14 — cambric 11*s* 4*d*	—		7	18	8
34 — printed linen 2*s* 6*d*	—		4	5	—
		£	27	8	9

Sir *Sampſon Rock*, Bart.

To *Zachary Sugarloaf* Dr.

1772		£	s.	d.
Jan. 4:	To 8½ ℔. of raiſins at 6*d* ½ *per* ℔	–	4	7¼
12:	16 ℔. of currants at 4*d*	–	5	4
	20 ℔. of *Malaga* raiſins 5*d* ¾	–	9	7
	7 ℔. of rice 4*d* —	–	2	4
Feb. 14:	4 ℔. of pepper at 1*s* 6*d*	–	6	–
Mar. 6:	6 ſugar loaves, wt. 60 ℔. at 9*d*	2	5	–
18:	7 oz. of cloves at 1*s* 4*d*	–	9	4
		£4	2	2¼

London 7th, of *March* 1772.

Simon Bateman Eſq.

Bought of *Roger Wineſeller*.

			£.	s.	d.
Port red	15 gallons at	6*s* 4*d per* gal.	4	15	–
Claret	20 ——	9*s* 2*d* —	9	3	4
Palm Sack	4 ——	7*s* 10*d* —	1	11	4
Liſbon white	40 ——	4*s* 3*d* —	8	10	–
Sherry	21 ——	5*s* 10*d* —	6	2	6
Rheniſh	24 ——	6*s* 2 —	7	8	–
			£37	10	2

Cheſter 12th, *May* 1772.

Mr. *Ambroſe Cob*

Bought of *John Cornchandler*.

	qrs.	*bu.*		£	s.	d.		£	s.	d.
Wheat	5	2	at	2	18	8	*per* qr.	15	8	–
Rye	9	6	at	1	14	–	——	16	11	6
Oats	10	4	at	–	14	8	—	7	14	–
Beans	–	10	at	–	4	2	*per buſh.*	2	1	8
Peas	–	12	at	–	3	1	—	1	17	–
								£43	12	2

Mrs. *Anne Wheedle*

To *Arthur Mercer* Dr.

1771		s.	d.		£.	s.	d.
Feb. 7 :	To 16 yards of silk at	14	6	*per* yd.	11	12	—
	14 — flower'd dit	16	—		11	4	—
Nov. 24 :	12 — brocade	12	4		7	8	—
1772 *April* 16 :	18 yds. luteſt.	7	—		6	6	—
Auguſt 15 :	5 velvet	19	6		4	17	6
28 :	14 ſattin	10	6		7	7	—
					£48	14	6

1771	£	s.	d.			
June 28 : By caſh receiv'd	15	4	6			
Nov. 24 : Bill on *Davies* & *Lang*	8	18	6			
1772 *May* 2 : Caſh —	7	14	—			
				31	17	—
Balance due				£16	17	6

London 6th, *Feb.* 1772.

Mr. *Swithin Shakeſpear*

Bought of *Charles Cheeſemonger*

	C.	qr.	lb.	£.	s.	d.		£.	s.	d.
12 *Cheſhire* cheeſes	6	1	14	at 1	18	6	*per*	12	5	5¼
16 *Glouceſter* ditto	4	—	16	at 1	16	—	—	7	9	1½
40 *Stilton* ditto	1	1	4	at 2	12	8	—	3	7	8½
10 Flitches of bacon 60 ſtone					6	4	*per* ſt.	19	—	—
20 Firkins of *Iriſh* butter at £1 2s each fir.								22	—	—
								£64	2	3¼

Salop March 12th, 1772.

Mr. *Job Standfaſt*

Bought of *James Ray*, 4 caſks of ſugar.

	C.	*qrs.*	*lb.*			
No. 1.	5	3	12	*qrs.*	*lb.*	
2.	6	2	16	Tare 2	26	each caſk.
3.	7	1	11		4	
4.	8	1	14			
				C. 2	3	20 whole tare
Groſs	28	–	25			
Tare	2	3	20			
Neat	25	1	5	at 2*l.* 4*s. p. C.*	£55	12 11½

Form of a Carpenter's Bill from the celebrated Mr. *George Bickham's* Univerſal Penman.

Conrade Dubois Eſq. Dr.

To *Henry Sims* for work and materials in his Houſe at *Henley-Park Surry*.

1738		£.	*s.*	£	*s.*	*d.*
May 18 :	Oak tim. 12 load at	2	5 a ton	33	15	–
27 :	Fir tim. 35 t. at 1*l* 12*s* 10*d* a ld.			45	19	4
June 11 :	Oak plank 96 foot –		3½ *p.* ft.	1	8	–
15 :	*Norw* deals 590 at 6*l* 15*s p.* hd.			33	3	9
29 :	Sixpenny nls. 29 tho.		3*s* 10*d p.* m.	5	11	2
	Ten groat nls 30 do.		14*s* 10*d* do.	22	5	–
July 16 :	Work for ſelf 90 days		3*s* 4*d p.* day	15	–	–
	— for 1 man 90 do.		2*s* 6*d* –	11	5	–
	Wainſcot 73 yds.		3*s* 2*d p.* yard	11	11	2
	Double quarter 58 feet		4*d. p.* foot –		19	4
				£180	17	9

Note. Deals and Nails are 120 to the hundred, 50 feet are a load, and 40 feet a ton of timber.

VULGAR FRACTIONS.

FRACTIONS direct you very clear,
When parts of Integers appear;
How to proceed, their value find,
Tho' e'er so variously combin'd.

NOTATION.

Any unit or integer, divided into parts is expreſſed by two numbers thus $\frac{3}{4}$, the lower number is called the *denominator*, and the upper the *numerator*, which ſhews how many parts of the denominator the given fraction conſiſts of. The denominator denotes how many equal parts, any integer or quantity is ſuppoſed to be divided into; and is no more than a *diviſor* in *ſimple Diviſion*.

Fractions are either *proper*, *improper*, or *compound*.

When the numerator is leſs than the denominator it expreſſes a *ſimple ſingle* or *proper fraction* as $\frac{1}{2}$, $\frac{3}{4}$, $\frac{6}{9}$, $\frac{12}{120}$ &c.

When the numerator is equal to or greater than the denominator, it denotes an *improper fraction* as $\frac{5}{5}$, $\frac{6}{3}$, $\frac{12}{4}$, $\frac{164}{91}$ &c.

When ſeveral fractions come together, coupled or joined with the particle *of* as $\frac{2}{3}$ *of* $\frac{3}{4}$ *of* $\frac{4}{6}$ (*read or verbally expreſs'd thus, two thirds of three fourths of four ſixths*) they are *compound fractions* or *fractions of fractions*, and to render this more plain and conſpicuous, admit a pound ſterling to be divided in this manner.

	s.			
6)	20			
	—	*d*		
	3	4 = $\frac{1}{6}$		of a £.
		4		
4)	13	4 = $\frac{4}{6}$		
	3	4 = $\frac{1}{4}$		of $\frac{4}{6}$ of a £.
		3		
3)	10	— = $\frac{3}{4}$		
	3	4 = $\frac{1}{3}$		of $\frac{3}{4}$ of $\frac{4}{6}$ of a £.
		2		
	6	8 = $\frac{2}{3}$		

A whole number with a fraction annexed, is called a *Mixt number* and is expreſſed thus 12 $\frac{3}{4}$ *viz.* 12 units and $\frac{3}{4}$ of a unit, *i. e.* a unit is broken or divided into 4 parts, and 3 of thoſe parts muſt be taken to add to the whole number 12.

Reduction of Vulgar Fractions.

CASE I.

To reduce any given fraction ***to another of*** equal value.

RULE.

Both terms divide or multiply
By the ſame number, you'll eſpy
A *fraction* new,—whoſe value's even
Equivalent to what was given.

EXAMPLE.

Suppoſe the *fraction* be $\frac{5}{8}$ now according to the *rule* multiply the given fraction by 6, *i. e.* both numerator and denominator muſt be multiplied thereby. *See the work.*

5 8
6 6
— —
30 48 Whence the new fraction is $\frac{30}{48} = \frac{5}{8}$. again divide both terms of the new fraction by 6. 6) $\frac{30}{48}$ ($\frac{5}{8}$ the fraction propoſed.

CASE 2.

To reduce any whole number *into the form of a* fraction.

RULE:

Be the *whole number* great or ſmall,
Write down a *unit* under all.

This is no more than under any whole number, as 6, 8, 12 &c, to write down a unit, and you have the fractional quantity. As $\frac{6}{1}$, $\frac{8}{1}$, $\frac{12}{1}$ &c.

CASE 3.

To reduce any whole number *to a* fraction *of a* given denomination.

RULE.

By the denominator you,
Muſt multiply your number true;
Under the product, *Tyro* ſee,
That your denominator be.

EXAMPLE.

Reduce 12 into a fraction whoſe denominator ſhall be 9.

12
9
—
108 Numerator, then $\frac{108}{9}$ is the fraction required.

CASE 4.

To reduce a compound fraction *to a* ſingle-one *of the ſame value.*

RULE.

Now all the numerators ſee,
They multipli'd together be;
Work the denominators ſo,
The ſingle fraction then you'll know.

EXAMPLE.

Reduce $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{5}{7}$ to a ſingle or ſimple fraction.

2	3
3	4
6	12
5	7
30 *N.*	84 *D.*

Whence $\frac{30}{84}$ is the fraction required.

Note, *N* ſtands for numerator, and *D* for denominator.

COROLLARY.

The above *compound fraction* may be reduced to a *ſingle one*, by cancelling or rejecting ſuch numerators as are equal to or diviſible by any of the denominators; and here it may be obſerved, that the denominator of the 2d, fraction is diviſible by the numerator of the 1ſt, and the numerator of the 2d, by the denominator of the 1ſt, then $2 \times 7 = 14$ *D.* and 5 is the *N.* as above, which fraction is equal to $\frac{30}{84}$ by the rule in *page* 243

CASE 5.

To reduce any mixt number *to an* improper fraction.

RULE.

By the denominator you
Muſt multiply th' whole number true;
Unto the product, likewiſe add
Your numerator—then is had
A numerator, new and clear,
As underneath is made t' appear.

EXAMPLE.

Reduce $24\frac{4}{9}$ to an improper fraction.

$24\frac{4}{9}$
9

220 *N.* therefore $\frac{220}{9}$ is the fraction required.

Note. After the ſame manner may any *mixt number* be reduced to an *improper fraction*.

CASE 6.

To reduce an improper fraction *to its* equivalent, whole *or* mixt number.

RULE.

Divide the numerator true
By the denominator, you
Th' integral part will fairly ſee,
And if remainders any be,
O'er the diviſor place the ſame,
And you the fractional part may name.

EXAMPLE 1.

Reduce $\frac{220}{9}$ to its equivalent whole or mixt number.

9) 220

Anſw. $24\frac{4}{9}$

EXAMPLE 2.

Reduce $\frac{780}{12}$ to its equivalent whole or mixt number.

12) 780

Anſw. 65

Note. This and the five *preceding caſes* are ſo eaſy, that any more examples therein wou'd be prolixity only.

CASE

CASE 7.

To find the greateſt common meaſure *or* diviſor *for the numerator and denominator of any given* fraction, *or* for any two numbers.

RULE.

The greateſt term by th' leaſt divide,
Th' diviſor by what remains beſide;
And thus proceed 'till nought remains,
The meaſure's found with little pains.

EXAMPLE.

What is the greateſt common meaſure of $\frac{124}{216}$?

```
124) 216 (1
     124
     ---
      92) 124 (1
          92
          --
          32) 92 (2
              64
              --
              28) 32 (1
                  28
                  --
                   4) 28 (7
                      28
                      --
                       0
                      --
```

Anſw. 4 is the greateſt number or common meaſure that will divide both numerator and denominator without a remainder.

When there are mixt numbers given, they muſt be reduced to a common denominator, then proceed with the two new numerators to find their greateſt common meaſure, make that the numerator, and under put the common denominator, which fraction will be the greateſt common meaſure ſought or required.

EXAMPLE

What is the greateſt common meaſure of $7\frac{1}{4}$ and 16?

Firſt, theſe are to be reduced to a common denominator as before explain'd, thus

$7\frac{1}{4}$ 16

4 4 $\frac{30}{4}$ and $\frac{64}{4}$

30 *N.* 64 *N.*

30) 64 (2
60
—
4) 30 (7
28
—
2) 4 (2
4
—
—

Anſw. $\frac{2}{4}$ is the greateſt common meaſure of $7\frac{2}{4}$ and 16.

CASE 8.

To reduce a fraction to its leaſt *or* loweſt terms.

RULE.

The *greateſt common meaſure* * find,
By which divide both terms combin'd,
Of any *fraction*,—then moſt ſure,
The quotients will the terms procure.

EXAMPLE I.

Reduce $\frac{204}{228}$ to its leaſt terms.

204) 228 (1
204
—
24) 204 (8
192
—
12) 24 (2
24
—
—

$\frac{12}{12}$) $\frac{204}{228}$ ($\frac{17}{19}$ Anſwer

* If the *common meaſure* happens to be an unit, the fraction is in its *loweſt terms* already. EXAM-

EXAMPLE 2.

Reduce $\frac{1656}{1932}$ to its loweſt terms.

1656) 1932 (1
1656
276) 1656 (6
1656

$\frac{276}{276}$) $\frac{1656}{1932}$ ($\frac{6}{7}$ Anſwer

SCHOLIUM.

To abbreviate any given fraction which is diviſible by any number as 2, 3, 4, 5, 6, 7, &c.—The fraction is eaſily reduced to its leaſt terms, by dividing both the numerator and denominator by ſuch a number, as evidently appears by the following

EXAMPLES.

Reduce $\frac{44}{112}$ into its leaſt terms.

This fraction halved is $\frac{22}{56}$ which being alſo halved is $\frac{11}{28}$, and is of equal value to the given fraction $\frac{44}{112}$.

Reduce $\frac{65}{80}$ into its leaſt terms.

This fraction ending with 5 and a cipher is diviſible by 5. 5) $\frac{65}{80}$ ($\frac{13}{16}$ Anſwer

Reduce $\frac{318}{6114}$ into its leaſt terms.

This fraction it is plain is diviſible by 3) $\frac{318}{6114}$ ($\frac{106}{2038}$

Reduce $\frac{100}{24000}$ to its leaſt terms.

By cutting off the ciphers the fraction will ſtand in its loweſt terms, thus $\frac{1}{24}$.

CASE 9.

To reduce fractions *of unequal or different denominators to* thoſe *of equal value with a common denominator.*

RULE

RULE.

The numerator multiply,
Of ev'ry fraction that is by,
Into th' denominators clear,
Except its own, there will appear
New numerators,—laſtly do,
Multiply th' denominators ſo,
Into each other and you'll ſee
A new denominator 'll be.

EXAMPLE I.

Reduce $\frac{2}{9}$, $\frac{3}{4}$ $\frac{6}{9}$ $\frac{4}{9}$ into fractions of one common denominator.

2	3	6	4
9	4	9	9
18	12	54	36
12	12	4	12
216 *N.*	144 *N.*	216 *N.*	432 *D.*

Whence $\frac{2}{9} = \frac{216}{432} = \frac{6}{12}$ and $\frac{3}{4} = \frac{144}{432}$.

EXAMPLE 2.

Reduce $14\frac{2}{3}$, 7 and $\frac{2}{3}$ of $\frac{5}{8}$ of $\frac{3}{9}$ and $\frac{4}{7}$ to fractions of one common denominator.

Firſt $14\frac{2}{3} = \frac{44}{3}$, $7 = \frac{7}{1}$, and the compound fraction $\frac{2}{3}$ of $\frac{5}{8}$ of $\frac{3}{9} = \frac{30}{216} = \frac{5}{36}$ in its loweſt terms. *Then* the fractions to be reduced to a common denominator are $\frac{44}{3}$, $\frac{7}{1}$, $\frac{5}{36}$ and $\frac{4}{7}$.

44	7	5	4	3	
1	3	1	36	1	
44	21	5	144	3	
36	36	3	1	36	
264	126	15	144	108	
132	63	7	3	7	
1584	756	105 *N.*	432 *N.*	756	Com. denom.
7	7				
11088 *N.*	5292 *N.*				

Anſwer $\frac{11088}{756} = \frac{44}{3} = 14\frac{2}{3}$, $\frac{5292}{756} = \frac{7}{1} = 7$, $\frac{105}{756} = \frac{5}{36} = \frac{2}{3}$ of $\frac{5}{8}$ of $\frac{3}{9}$, and $\frac{432}{756} = \frac{4}{7}$.

Note. It frequently happens that fractions may be reduced to a common denominator, *more eaſily and in far leſs terms*, than by the general method of involving the numerator of each fraction into the denominators of all the others, &c. As ſuppoſe the fractions $\frac{3}{50}$ and $\frac{1}{40}$ were to be reduced to a common denominator, by the general method the common denominator will be 2000 but it is very obvious that by the rule in *page* 243 theſe fractions may be reduced to *ſuch* whoſe common denominator will be but 200 for $\frac{3}{50}$ multiplied by 4 and $\frac{1}{40}$ by 5 produce $\frac{12}{200}$ and $\frac{5}{200}$ and which are equivalent or equal in value to $\frac{120}{2000}$ and $\frac{50}{2000}$ the fractions when reduced by the common method.—Again, admit $\frac{1}{3}$, $\frac{3}{8}$ and $\frac{5}{12}$ were to be reduced to a common denominator, by the general method the common denominator will be 288 but it may be eaſily diſcovered that theſe fractions may (by the aforeſaid rule in *page* 243) be reduced to *ſuch* whoſe common denominator will be but 24 for by multiplying $\frac{1}{3}$ by 8, $\frac{3}{8}$ by 3, and $\frac{5}{12}$ by 2 they will become

become $\frac{8}{24}$, $\frac{9}{24}$ and $\frac{10}{24}$, and which are equivalent to $\frac{96}{288}$, $\frac{108}{288}$ and $\frac{120}{288}$ the fractions when reduced the common way.—And the fractions of the *firſt example* of *this Caſe*, *viz.* $\frac{2}{4}$, $\frac{1}{6}$ and $\frac{6}{12}$ being abbreviated become $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{2}$ and which by this method may be reduced to *ſuch* whoſe common denominator will be 6, for the two fractions $\frac{1}{2}$ and $\frac{1}{2}$ being ſeverally multiplied by 3, and $\frac{1}{3}$ by 2 make $\frac{3}{6}$, $\frac{2}{6}$ and $\frac{3}{6}$ and which (as may be ſeen in *page* 250) are equivalent to $\frac{216}{432}$, $\frac{144}{432}$ and $\frac{216}{432}$ the fractions when reduced the common way, ſo that by proceeding after this manner (where the caſe will admit) a multiplicity of figures and tedious work will be ſaved.

And here it will be very neceſſary to acquaint the learner *(what moſt authors have omitted)* that if one fraction be equivalent to another it will hold, as the numerator of the *one* is to its denominator ſo is the numerator of the *other* to its denominator, or, as one numerator to the *other* ſo is one denominator to the *other*. And alſo the numerator of the *one* multiplied by the denominator of the *other*, will be equal to the denominator of the *one* multiplied by the numerator of the *other*.—And now admit it was required to know whether the laſt mentioned fraction in the *ſecond example* of this *caſe viz.* $\frac{432}{567}$ be equal (as it is there ſaid to be) to $\frac{4}{7}$, it certainly is, for 432 multiplied by 7 is equal to 756 multiplied by 4.—Or (by the *common Rule of Three*) as 432 (the numerator of the one fraction) is to 756 (its denominator) ſo is 4 (the numerator of the *other*) to 7 its denominator.—Or as 432 is to 4 ſo is 756 to 7 the denominator as before. And it is plain that the fraction $\frac{4}{7}$ is equal to $\frac{432}{756}$ for as 4 is to 7 ſo is 432 to 756, ſo that by any of theſe methods, it may be eaſily known whether any one fraction be equivalent to another, without finding their reſpective values in the known parts of the integer.

CASE

CASE 10.

To reduce coins, weights, measures *&c. into* fractions.—Suppose 6*s.* and 4*d.* were to be reduced to the fraction of a pound *Sterling*. This is no more than to make the pence in 6*s.* and 4*d.* the numerator to 240 the pence in a pound.

s. d.
6 4
12
—
76 *N.*

Then $\frac{76}{240}$ is the fraction required $= \frac{19}{60}$ in its lowest terms.

EXAMPLE 2.

Reduce 6*d* $\frac{1}{2}$ to the fraction of a shilling.

6 $\frac{1}{2}$
2
—
13 *N.* Answ. $\frac{13}{24}$
—

EXAMPLE 4.

Reduce 2 R. 14pls. to the fraction of an acre.

2 r. 14 pls.
40
—
94 *N.* Answ. $\frac{94}{160} = \frac{47}{80}$ in its least terms.)

EXAMPLE 3.

Reduce 4*C.* 1 *qr.* 12 *lb.* to a fraction of 1 *C.* weight

C. qr. lb.
4 1 12
4
—
17
28
—
488 *N.*
—

Answ. $\frac{488}{112} = \frac{61}{14}$ in its least terms.

Note. After the same manner may any other weights, measures &c. be reduced to fractions.

CASE 11.

When fractions are to be reduced *to other equivalent ones*, of a different integer, *i. e.* when the given fraction is to be brought from a greater to a less denomination, or from a less to a greater, observe the following

RULE.

If a leſs denomination's ſought,
From any greater to be brought,
The *numerator* multiply
By th' integral parts, you'll ſoon deſcry
A numerator new and clear,
To its denominator there.
And when a greater you require,
To multiply you muſt prepare
Th' *denominator* by thoſe parts,
This do, and maſter be of arts.

EXAMPLE 1.

Reduce $\frac{4}{17}$ *l.* to an equivalent fraction of a penny.

4
20
— Anſw. $\frac{960}{17} = \frac{60}{1}$ in
80 its leaſt terms.)
12
—
960 *N.*
—

EXAMPLE 2.

Reduce $\frac{8}{12}$ of a ſhilling to the fraction of a farthing.

8
12
—
96 Anſw. $\frac{384}{12} = \frac{192}{6}$
4 $= \frac{96}{3} = \frac{32}{1}$.
—
384 *N.*
—

EXAMPLE 3.

Reduce $\frac{3}{7}$ *lb* Troy to the fraction of a pennyweight.

3
12
— Anſw. $\frac{720}{7}$
36
20
—
720 *N.*
—

EXAMPLE 4.

Reduce $\frac{6}{8}$ of a ſhilling to the fraction of a pound.

8
20 Anſw. $\frac{6}{160} = \frac{3}{80}$ in
— its loweſt terms)
160
—

EXAM-

EXAMPLE 5.

Reduce $\frac{18}{160}$ of a farthing, to the fraction of a pound.

160
4
640
12
7680
20
153600 *D.*

Anſw. $\frac{18}{153600} = \frac{3}{25600}$ in its leaſt terms

EXAMPLE 6.

Reduce $\frac{4}{12}$ of ℔ to the fraction of a *C.* weight.

12
28
336
4
1344 *D.*

Anſw. $\frac{4}{1344} = \frac{1}{336}$ in its loweſt terms.

Or otherwiſe by compound fractions.

D. $\frac{4}{12}$ of $\frac{1}{28}$ of $\frac{1}{4} = \frac{4}{1344}$ as before.

EXAMPLE 7.

Reduce $\frac{3}{4}$ of a pound to the fraction of a guinea.

3 4
20 21
60 *N.* 84 *D.*

Anſw. $\frac{60}{84} = \frac{30}{42} = \frac{15}{21} = \frac{5}{7}$ in its leaſt terms.

EXAMPLE 8.

Reduce $\frac{5}{7}$ of a guinea to the fraction of a pound.

5 21
21 20
105 *N.* 140 *D.*

Anſw. $\frac{105}{140} = \frac{21}{28} = \frac{3}{4}$ in its loweſt terms.

CASE 12.

To find the value of any fraction *in money, weight or meaſure.*

RULE.

The numerator multipli'd
By th' integer—then next divide
The product true, be what it will,
By th' denominator ſtill.
Th' remainder too, reduce as low,
As th' loweſt terms are pleas'd to go.

EXAMPLE 1.

Required the value of $\frac{157}{192}$ of a pound *Sterling*.

157
20
---
s
192) 3140 (16
192

1220
1152

68
12
---
d
192) 816 (4
768

48
4
---
192) 192 (¼
192

Anſw. £— 16s 4d ¼

EXAMPLE 4.

What is the value of $\frac{5}{8}$ of 8s 10d?

s d
8 10
5
---
8) 2 4 2

5s 6d ½

EXAMPLE 2.

What is the value of $\frac{7}{9}$ of a guinea?

21
7
---
9) 147

Anſw. 16s 4d

EXAMPLE 3.

What is the value of $\frac{4}{9}$ of a pound *Avoirdupoiſe*?

4
16
---
9) 64
---
7 oz. 1 dr. 7/9

EXAMPLE 5.

What is the value of $\frac{4}{18}$ of an acre?

4
4

16
40
---
3) 640
---
18 { 6) 213—1 } 10

35—3

Anſ. $35\frac{10}{18}$ pls. = $35\frac{5}{9}$ pls.

After

After the ſame manner may the value of any fraction be found, but there is another method whereby the value may be eaſily exhibited, which is (as in *page* 243) to divide the integer by the denominator, and to multiply that quotient by the numerator: As ſuppoſe the value of $\frac{7}{9}$ of a guinea was required, now 21 ſhillings (a guinea) being divided by 9, the denominator of the fraction, quotes 2*s* and 4*d* (the 9th of a guinea) which being multiplied by the numerator 7, produces 16*s* and 4*d* the anſwer the ſame as in *page* 256.

ADDITION of VULGAR FRACTIONS.

RULE.

THE numerators firſt be ſure
To add, and then you will procure
A numerator, new and fair,
Under the ſame you muſt take care,
To write down clear to public view
Th' common denominator true.

SCHOLIUM.

In *Addition* or *Subtraction* of *Vulgar Fractions* obſerve, that all *Compound Fractions* muſt be reduced to *ſimple ones*, and all to the ſame integer and denominator, if they are of different denominations.

EXAMPLE 1.

What is the ſum of $\frac{5}{18}$ and $\frac{7}{18}$?

To 5
Add 7

12

— Anſw. $\frac{12}{18} = \frac{2}{3}$ in (its leaſt terms.

EXAMPLE 2.

What is the ſum of $\frac{4}{12}$ and $\frac{9}{12}$?

To 4
Add 9

13

— Anſw. $\frac{13}{12} = 1\frac{1}{12}$

EXAMPLE 3.

What is the ſum of $\frac{5}{6}$ and $\frac{5}{7}$?

5	5	6
7	6	7
35 *N.*	30 *N.*	42 *D.*

Then the fractions to be added are $\frac{35}{42}$ and $\frac{30}{42}$ whoſe *ſum* is $\frac{65}{42} = 1\frac{23}{42}$.

EXAMPLE 4.

Add $\frac{1}{2}$, $\frac{3}{4}$ and $\frac{3}{5}$ together.

Theſe fractions reduced to a common denominator (by the *note* to *caſe* 9 *page* 251) are $\frac{10}{20}$, $\frac{15}{20}$ and $\frac{12}{20}$ which being added together make $\frac{37}{20} = 1\frac{17}{20}$ Anſ.

EXAMPLE 5.

What is the ſum of $\frac{3}{5}$ of $\frac{4}{6}$, $\frac{2}{7}$ and $1\frac{1}{4}$?

Firſt $\frac{3}{5}$ of $\frac{4}{6} = \frac{12}{30} = \frac{2}{5}$ and $1\frac{1}{4} = \frac{5}{4}$

Then $\frac{2}{5}$, $\frac{2}{7}$ and $\frac{5}{4}$ reduced to a common denominator are $\frac{56}{140}$, $\frac{40}{140}$ and $\frac{175}{140}$ whoſe *ſum* is $\frac{271}{140} = 1\frac{131}{140}$.

EXAMPLE 6.

Add $14\frac{7}{8}$, $23\frac{1}{4}$ and $26\frac{5}{9}$ together.

There are two ways whereby this and ſuch like queſtions may be done, one whereof is to reduce the mixt numbers to improper fractions, and thoſe to a common denominator. The other is only to reduce the fractional parts of the mixt numbers to fractions of one common denominator, and to add their ſum to the whole or integral parts, and which is far more preferable than the firſt method, by ſaving a multiplicity of figures as may be ſeen by the following operations.

Method 1.

Firſt $14\frac{7}{8} = \frac{119}{8}$, $23\frac{1}{4} = \frac{93}{4}$ and $26\frac{5}{9} = \frac{239}{9}$

Then $\frac{119}{8}$, $\frac{93}{4}$ and $\frac{239}{9}$ reduced to fractions of a common denominator (by the *note* to *caſe* 9 *page* 251) are $\frac{1071}{72}$, $\frac{1674}{72}$ and $\frac{1912}{72}$ the ſum whereof is $\frac{4657}{72} = 64\frac{49}{72}$ Anſwer.

Method

Method 2.

First, the fractions in this example *viz.* $\frac{7}{8}$, $\frac{1}{4}$ and $\frac{5}{9}$ reduced to fractions of a common denominator (by the *Note* to *Case* 9 *page* 251) are $\frac{63}{72}$, $\frac{18}{72}$ and $\frac{40}{72}$ which being added together make $\frac{121}{72} = 1\frac{49}{72}$. *Then* $1\frac{49}{72}$ (the sum of the fractions) added to the whole numbers 14, 23 and 26 make $64\frac{49}{72}$ the answer as before.

Example 7.

What is the sum of $\frac{5}{6}$ of a *moidore*, $\frac{5}{6}$ of a *pound* and $\frac{7}{9}$ of *half a guinea*.

First $\frac{5}{6}$ of a moidore = to the compound fraction $\frac{5}{6}$ of $\frac{27}{20} = \frac{135}{120}$ £. and $\frac{7}{9}$ of half a guinea = to the compound fraction $\frac{7}{9}$ of $\frac{1}{2}$ of $\frac{21}{20} = \frac{147}{360} = \frac{49}{120}$ £. Now these two fractions $\frac{135}{120}$ and $\frac{49}{120}$ have a common denominator, and by multiplying the *other viz.* $\frac{5}{6}$ £ by 20 (*see Case* 1 *page* 243) it will have the same denominator (as the other two fractions) by becoming $\frac{100}{120}$ *Then* the fractions to be added are $\frac{135}{120}$, $\frac{49}{120}$ and $\frac{100}{120}$ whose *sum* is $\frac{284}{120} = \frac{71}{30} = £2\ 7s.\ 4d.$

Example 8.

Admit I sail where billows roar,
And plow the raging sea,
And steering to a *foreign* shore,
A prize falls in my way;
When having chang'd a full broad side,
As *Anson* us'd to do,
Or *Drake*, and many more beside,
Who boldly dar'd the foe.
Suppose this prize ten thousand pound,
Three fiftieths is my share,
Another Sailor's share is (found
His part) *two eightieths* (are)
I purchase *this* then what's to me,
The total worth define,
And you shall with *Minerva* be,
And in her temple shine.

First

First $\frac{2}{50}$ (the purchaſed ſhare) = $\frac{1}{40}$ *then* $\frac{3}{50}$ and $\frac{1}{40}$ reduced to a common denominator (ſee the *note* to *caſe* 9 *page* 251) make $\frac{12}{200}$ and $\frac{5}{200}$ whoſe ſum is $\frac{17}{200}$. And to find the value of $\frac{17}{200}$ of £ 10000 (the whole prize) proceed thus

10000
17
2|00) 1700|00
Anſwer £ 850

But this queſtion may be eaſily anſwered by finding the value of $\frac{3}{50}$ and alſo the value of $\frac{1}{40}$ of £ 10000 ſeparately and adding them together, *See the work.*

4|0) 1000|0
3
5|0) 3000|0

To 600 } the { Sailor's own ſhare
Add 250 } the { purchaſed one

Anſwer £850 the ſame as before.

SUBTRACTION of VULGAR FRACTIONS.

RULE.

AS in *Addition* firſt prepare,
Your fractions with peculiar care,
Of both the numerators ſee,
The difference deducted be,
And a new numerator then
Is found—now *Tyro* take your pen,
And under this beſure to write,
Th' common denominator ſtraight. EXAM-

EXAM. 1.	EXAM. 2.	EXAM. 3.	EXAM. 4.
From $\frac{19}{67}$	From $\frac{17}{85}$	From $14\frac{15}{19}$	From $98\frac{15}{17}$
Take $\frac{13}{67}$	Take $\frac{14}{85}$	Take $8\frac{4}{19}$	Take $89\frac{9}{17}$
Anſ. $\frac{6}{67}$	Anſ. $\frac{3}{85}$	Anſw. $6\frac{11}{19}$	Anſ. $9\frac{6}{17}$
Proof $\frac{19}{67}$	Proof $\frac{17}{85}$	Proof $14\frac{15}{19}$	Proof $98\frac{15}{17}$

EXAMPLE 5.

£.	
From 576	$\frac{15}{27}$
Take 458	$\frac{16}{27}$
Anſw. 117	$\frac{26}{27}$
Proof 576	$\frac{15}{27}$

as above.

To work this example, ſay 16 from 15 I cannot, but 27 (the parts the integer is divided into) that I borrow'd to 15, is 42, 16 from 42 and there remains 26, which ſet down as a numerator to the denominator 27, and carry 1 to the 8 and proceed as in *common ſubtraction* and the anſwer or remainder will be $117\frac{26}{27}$

EXAMPLE 6.

Subtract $\frac{4}{6}$ of $\frac{2}{10}$ from $\frac{3}{5}$.

Firſt $\frac{4}{6}$ of $\frac{2}{10} = \frac{2}{3}$ of $\frac{1}{5}$ $= \frac{2}{15}$

Then (by *caſe* 1 *page* 243) $\frac{3}{5} = \frac{10}{15}$ from which ſubtract $\frac{2}{15}$ (the $\frac{4}{6}$ of $\frac{2}{10}$) and the *remainder* will be $\frac{8}{15}$

EXAMPLE 7.

Subtract $12\frac{3}{4}$ from $16\frac{1}{3}$

Firſt $12\frac{3}{4} = \frac{51}{4}$, and $16\frac{1}{3} = \frac{49}{3}$.

Then ſubtract $\frac{51}{4}$ from $\frac{49}{3}$.

51	49	4
3	4	3
153 *N.*	196 *N.*	12 *D.*

From	196
Take	153
Rem.	43

Anſw. $\frac{43}{12} = 3\frac{7}{12}$.

Or

Or thus

First, the fractions in this example *viz.* $\frac{3}{4}$ and $\frac{1}{3}$ reduced to a common denominator are $\frac{9}{12}$ and $\frac{4}{12}$ which being added to their reſpective whole numbers make $12\frac{9}{12}$ and $16\frac{4}{12}$ then

From	16	$\frac{4}{12}$
Take	12	$\frac{9}{12}$
Anſw.	3	$\frac{7}{12}$ as before.

MULTIPLICATION of VULGAR FRACTIONS.

RULE.

ALL th' numerators multiply
Together, and you'll ſoon eſpy
Your numerator very clear,
As quickly will be made t' appear;
Next the denominators too,
Thus multipli'd together ſhew
The fraction fair, I tell you true.

EXAMPLE 1.

Multiply $\frac{3}{4}$ by $\frac{5}{8}$

3	4
5	8
15 *N.*	32 *D.*

Anſw. $\frac{15}{32}$

EXAMPLE 2.

Multiply $\frac{4}{16}$ by $\frac{12}{42}$

First $\frac{4}{16} = \frac{1}{4}$, and $\frac{12}{42} = \frac{2}{7}$

Then the fractions to be multiplied are $\frac{1}{4}$ and $\frac{2}{7}$.

1	4
2	7
2 *N.*	28 *D.*

Anſ. $\frac{2}{28} = \frac{1}{14}$

EXAMPLE

EXAMPLE 3.

Multiply $\frac{6}{7}$ by $\frac{3}{4}$ of $\frac{4}{5}$

First $\frac{3}{4}$ of $\frac{4}{5} = \frac{12}{20} = \frac{3}{5}$

Then the fractions to be multiplied are $\frac{6}{7}$ and $\frac{3}{5}$.

6	7
3	5
18 *N.*	35 *D.*

Anſw. $\frac{18}{35}$.

EXAMPLE 4.

Multiply $5\frac{3}{6}$ by $7\frac{2}{3}$.

First $5\frac{3}{6} = 5\frac{1}{2} = \frac{11}{2}$, and $7\frac{2}{3} = \frac{23}{3}$

Then, the fractions are $\frac{11}{2}$ and $\frac{23}{3}$.

11	2
23	3
253 *N.*	6 *D.*

Anſw. $\frac{253}{6}$ $(= £42\frac{1}{6} = £42\ 3^s\ 4^d$

EXAMPLE 5.

Multiply $6\frac{3}{4}$ by $\frac{4}{5}$ and that product by 7 and *that* by $\frac{2}{3}$ of $\frac{3}{4}$.

First $6\frac{3}{4} = \frac{27}{4}$, $7 = \frac{7}{1}$ and $\frac{2}{3}$ of $\frac{3}{4} = \frac{6}{12} = \frac{1}{2}$.

Then the example will ſtand thus, multiply $\frac{27}{4}$ by $\frac{4}{5}$ and that product by $\frac{7}{1}$ and *that* by $\frac{1}{2}$.

27	4
4	5
108	20
7	1
756	20
1	2
756 *N.*	40 *D.*

Anſw, $\frac{756}{40} = \frac{189}{10} = 18\frac{9}{10}$.

DIVISION

DIVISION of VULGAR FRACTIONS.

RULE.

BE your diviſor what it will
And dividend, obſerve me ſtill;
Each numerator multiply,
In each denominator by—
Croſsways and you'll the quotient find,
Complete as hereunto's ſubjoin'd.

SCHOLIUM.

Fractions in *Diviſion* muſt be prepared by *Reduction*, the ſame as in the other rules, *i. e. Compound Fractions* muſt be reduced to *ſimple ones*, *mixt numbers* into *improper Fractions*, *whole numbers* expreſs'd Fractionwiſe, &c.

EXAMPLE 1.

Divide $\frac{4}{8}$ by $\frac{2}{7}$

$\frac{2}{7}) \frac{4}{8} (\frac{28}{16} = 1\frac{12}{16} = 1\frac{3}{4}$ Anſwer.)

EXAMPLE 2.

Divide $\frac{8}{12}$ by $\frac{3}{6}$

$\frac{3}{9}) \frac{8}{72} (\frac{72}{36} = 2$ Anſw.

EXAMPLE 3.

Divide $\frac{16}{112}$ by $\frac{4}{8}$

$\frac{4}{8}) \frac{16}{112} (\frac{4}{14} = \frac{2}{7}$ Anſw.

EXAMPLE 4.

Divide $\frac{28}{1008}$ by $\frac{7}{112}$

$\frac{7}{112}) \frac{28}{1008} (\frac{4}{9}$ Anſwer.

In

In this example, the numerator and denominator of the dividend, are both divisible by their respective terms in the divisor, and therefore bring out the answer as in example 3, and is the same *but in far less terms* than if multiplied cross-wise thus,

$\frac{4}{5}) \frac{16}{112} (\frac{128}{448} = \frac{2}{7}$ as before

EXAMPLE 7.

Divide $12\frac{3}{4}$ by $\frac{4}{7}$.

First $12\frac{3}{4} = \frac{51}{4}$

Then $\frac{4}{7}) \frac{51}{4} (\frac{357}{28} = 22$ $(\frac{5}{28}$ Answ.

EXAMPLE 9.

Divide $\frac{6}{7}$ by 4.

$\frac{4}{1}) \frac{6}{7} (\frac{6}{28} = \frac{3}{14}$

EXAMPLE 11.

Divide $\frac{3}{4}$ of a *pound* by $\frac{2}{3}$ of a *shilling*.

First $\frac{2}{3}$ of a shilling $= \frac{1}{30}$ of a pound

Then $\frac{1}{30}) \frac{3}{4} (\frac{90}{4} = \frac{45}{2} =$ £22 10*s*. Answ.

EXAMPLE 5.

Divide $\frac{3}{4}$ of $\frac{2}{5}$ by $\frac{4}{8}$

First $\frac{3}{4}$ of $\frac{2}{5} = \frac{6}{20}$ $\frac{3}{10}$ the dividend.

And $\frac{4}{8} = \frac{1}{2}$ the divisor

Then $\frac{1}{2}) \frac{3}{10} (\frac{6}{10} = \frac{3}{5}$ Ans.

EXAMPLE 6.

Divide $\frac{1}{2}$ of $\frac{3}{4}$ by $\frac{2}{5}$ of $\frac{6}{8}$.

First $\frac{1}{2}$ of $\frac{3}{4} = \frac{3}{8}$, and $\frac{2}{5}$ of $\frac{6}{8} = \frac{12}{40} = \frac{3}{10}$

Then $\frac{3}{10}) \frac{3}{8} (\frac{30}{24} = 1\frac{6}{24}$ $= 1\frac{1}{4}$ Answ.

EXAMPLE 8.

Divide $6\frac{3}{4}$ by $\frac{3}{4}$ of $\frac{2}{5}$.

First $6\frac{3}{4} = \frac{27}{4}$, and $\frac{3}{4}$ of $\frac{2}{5} = \frac{6}{20} = \frac{3}{10}$

Then $\frac{3}{10}) \frac{27}{4} (\frac{270}{12} =$ $\frac{135}{6} = 22\frac{3}{5}$ Answ.

EXAMPLE 10.

Divide 12 by $3\frac{4}{5} = \frac{19}{5}$

$\frac{19}{5}) \frac{12}{1} (\frac{60}{19} = 3\frac{3}{19}$ Ans.

EXAMPLE 12.

Divide $\frac{2}{3}$ of a *shilling* by $\frac{3}{4}$ of a *pound*.

First $\frac{2}{3}s = £\frac{1}{30}$ as before,

Then $\frac{3}{4}) \frac{1}{30} (\frac{4}{90} = \frac{2}{45} £ =$ 10*d*. $\frac{10}{15}$

SCHOLIUM.

I shall now proceed to the *Rule of Three*, having given various examples in *this*, whereby it may be easily observed that *Division of Fractions* is only to

reduce the given fractions (*being ſimple or improper ones*) to a common denominator, and to make a fraction of the new numerators, (*that* of the diviſor being made the denominator) which fraction is the quotient ſought, and muſt be reduced as the nature of the caſe may require.

RULE of THREE in VULGAR FRACTIONS.

RULE.

PREPARE your Fractions,—ſtate them free,
As in the common Rule of Three;
Firſt term's denominator you,
By th' numerators of th' other two
Muſt multiply, and then you'll ſee,
A numerator new will be,
Th' remaining terms next multiply
Th' denominator you'll deſcry.

EXAMPLE I.

If $\frac{2}{3}$ of a pound of tobacco coſt 8*d*. $\frac{3}{4}$. How many pounds may be bought for £25?

Firſt 8*d*. $\frac{3}{4}$ = $\frac{35}{4}$ of $\frac{1}{12}$ of $\frac{1}{20}$ = $\frac{35}{960}$ = $\frac{7}{192}$£ and £25 = $\frac{25}{1}$. *Then* ſay

	£.		*lb.*		£.
If	$\frac{7}{192}$	:	$\frac{2}{3}$	::	$\frac{25}{1}$

2	3
25	1
50	3
192	7
9600 *N.*	21 *D.*

Anſw. $\frac{9600}{21}$ = $\frac{3204}{7}$ = (457 lb $\frac{1}{7}$.

Or, reduce the *firſt* and *third terms* (for the ſake of variety) to the fractions of a ſhilling, and in order to ſhew that the *Rule of Three in Vulgar Fractions* is exactly the ſame as the *common one*, (reſpect being had to the rules in Fractions) multiply the *ſecond* and *third terms* together, divide the product by the *firſt*, and the quotient will be the anſwer. *See*

See the work.

First 8*d.* $\frac{3}{4} = \frac{35}{4}$ of $\frac{1}{12} = \frac{35}{48}$*s.* and £25 $= \frac{25}{1}$ of $\frac{20}{1} = \frac{500}{1}$*s.*

Then say If * $\frac{35}{48}$ *s.* : $\frac{2}{3}$ *lb.* :: $\frac{500}{1}$ *s.* $\frac{1000}{3}$ *lb.*

$\frac{35}{48}) \frac{1000}{3} (\frac{48000}{105} = \frac{3200}{7} = 457\frac{1}{7}$

(Answer as before.

2	3
500	1
1000 *N.*	3 *D.*

Example 2.

If $\frac{3}{5}$ of a *C.* weight cost £2 6*s.* 8*d.* what will $\frac{6}{7}$ cost?

C. £. *s.* *d.* £. *C.*

As * $\frac{2}{5}$: 2 6 8 = $\frac{7}{3}$ :: $\frac{6}{7}$

3	7	
7	3	
21	21	
6	2	Anſ. $\frac{126}{42} =$ (£3.
126 *N.*	42 *D.*	

Note. It may very eaſily be found that £2 6*s.* 8*d.* is equal to $\frac{7}{3}$ for 6*s.* is $\frac{6}{20}$ of a £ and 8*d.* is $\frac{8}{240}$ of $\frac{1}{20}$ of a £, which reduced to a ſimple fraction is $\frac{8}{240}$, & by multiplying the other fraction *viz.* $\frac{6}{20}$ by 12 (*ſee Caſe* 1 *page* 243) it will have the ſame denominator as $\frac{8}{240}$ by becoming $\frac{72}{240}$, the ſum of which two fractions in its loweſt terms is $\frac{1}{3}$, then £2 6*s.* 8*d.* is equal to £2 $\frac{1}{3}$ which being reduced to an improper fraction becomes $\frac{7}{3}$ as above.——But this may be done more readily by *Caſe* 10 *page viz.* 253 by making 80 the pence in 6*s.* and 8*d.* the numerator to 240 the pence in a pound, thus $\frac{80}{240}$, and which in its loweſt terms will be $\frac{1}{3}$ to which prefix 2. the whole number, makes £2 $\frac{1}{3}$ equal to the improper fraction $\frac{7}{3}$ as before.

Example 3.

If $\frac{4}{12}$ of a gentleman's eſtate be worth £400 10*s*. 6*d*. what is $\frac{16}{20}$ of the ſaid eſtate worth?

Firſt by *Reduction* $\frac{4}{12} = \frac{1}{3}$, £400 10*s*. 6*d*. = 400 $\frac{21}{40} = \frac{16021}{40}$, and $\frac{16}{20} = \frac{4}{5}$.

Then ſay

If * $\frac{1}{3}$: £ $\frac{16021}{40}$ :: $\frac{4}{5}$.

16021	40
4	5
64084	200
3	1
192252 *N.*	200 *D.*

Anſw. $\frac{192252}{200} = \frac{48063}{50}$

(= £961 5*s*. 2*d*. $\frac{2}{5}$

This example may be very elegantly ſolv'd for ($\frac{4}{12}$ being equal to $\frac{1}{3}$ therefore) 3 times £400 10*s*. 6*d*. will be the worth of the whole eſtate, from which deduct $\frac{1}{5}$ thereof ($\frac{16}{20}$ being equal to $\frac{4}{5}$) and the remainder will be the anſwer, *ſee the work.*

	£.	*s*.	*d*.	
	400	10	6	
			3	
5)	1201	11	6	whole eſtate
Deduct	240	6	$3\frac{3}{5}$	
Anſwer	£961	5	$2\frac{2}{5}$	as before

Example 4.

Some time ago, as people ſay,
A debt four men agreed to pay
Of juſt one pound, each ſhare was fix'd,
One third, one fourth, one fifth, one ſixth.
Then *Tyro* what was each man's due
Of caſh to pay? pray tell me true.

The

The fractions in this example *viz.* $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, and $\frac{1}{6}$, being reduced to a common denominator and added together, the sum will be (in its lowest terms) $\frac{19}{20}$, Then say

1st, If * $\frac{19}{20}$: $\frac{20}{1}$ :: $\frac{1}{3}$ s.
$\frac{19}{20}$) $\frac{20}{3}$ ($\frac{400}{57}$ = 7s $-d$ $\frac{4}{19}$

2dly, If * $\frac{19}{20}$: $\frac{20}{1}$ :: $\frac{1}{4}$ s.
$\frac{19}{20}$) $\frac{20}{4}$ ($\frac{400}{76}$ = 5s 3d $\frac{3}{19}$

3dly, If * $\frac{19}{20}$: $\frac{20}{1}$ :: $\frac{1}{5}$
$\frac{19}{20}$) $\frac{20}{5}$ ($\frac{400}{95}$ = 4s 2d $\frac{10}{19}$

4thly, If * $\frac{19}{20}$: $\frac{20}{1}$ :: $\frac{1}{6}$
$\frac{19}{20}$) $\frac{20}{6}$ ($\frac{400}{114}$ = 3s 6d $\frac{2}{19}$

		£.	s.	d.
Answer { 1st, 2d, 3d, 4th, } man's share {		–	7	– $\frac{4}{19}$
		–	5	3 $\frac{3}{19}$
		–	4	2 $\frac{10}{19}$
		–	3	6 $\frac{2}{19}$
Proof		1	–	–

Note. In these 4 operations the *second* and *third terms* are multiplied together, and the product divided by the *first*.

Example 5.

Suppose I buy 4 $\frac{1}{2}$ yards of cloth to make a coat, the cloth being 1 $\frac{1}{4}$ yard wide, how many yards of shalloon of $\frac{3}{4}$ wide will line the same?

First by *Reduction* 4 $\frac{1}{2}$ = $\frac{9}{2}$, and 1 $\frac{1}{4}$ = $\frac{5}{4}$.

Then as $\frac{5}{4}$: $\frac{9}{2}$ :: $\frac{3}{4}$ *

4	4
9	2
36	8
5	3
180 *N.*	24 *N.*

Answer $\frac{180}{24}$ = 7 $\frac{1}{2}$ yards

Or thus

5	4
9	2
45 *N.*	8 *D.* $\frac{3}{4}$) $\frac{45}{8}$ ($\frac{180}{24}$
	(= 7 $\frac{1}{2}$ as before.

Example 6.

Admit 8 men do a certain piece of work in $16\frac{3}{4}$ days. How long will 24 men be in doing the ſame?

As $\frac{8}{1}$: $16\frac{3}{4} = \frac{67}{4}$ :: $\frac{24}{1}$ *

1	1
67	4
67	4
8	24
536 *N.*	96 *D.*

Anſwer $5\frac{536}{96} = 5\frac{7}{12}$ days

Or thus

67	1
8	4
536 *N.*	4 *D.*

$\frac{24}{1}$) $\frac{536}{4}$ ($\frac{536}{96} = 5\frac{7}{12}$ days (as before.

Note. Theſe two laſt queſtions are in *Reciprocal Proportion*, as appears by the work.

DOUBLE RULE of THREE, or Rule of FIVE in VULGAR FRACTIONS.

RULE.

YOUR Queſtion ſtated, next proceed
To multiply your terms with ſpeed,
Firſt the three laſt, that product you
By th' reciprocals of the other two
Muſt multiply—the anſwer fair,
Will for inſpection then appear.

Example 1.

If 12 men are hired to do a piece of work in 8 days at 2*s.* 2*d.* *per* day, what will be the wages of 9 men for $20\frac{1}{2}$ days?

Firſt

First by *Reduction* the numbers expreſſed in fractions are $\frac{12}{1}$, $\frac{8}{1}$, 12 men at 2*s* 2*d per* Day $=$ £1 6*s* $=$ £1 $\frac{6}{20}$ $=$ 1 $\frac{3}{10}$ $=$ $\frac{13}{10}$. $\frac{9}{1}$ and $\frac{41}{2}$.

	m.		m.
*	$\frac{12}{1}$	$\frac{13}{10}$	$\frac{9}{1}$
*	$\frac{8}{1}$		$\frac{41}{2}$

9	2
41	10
369	20
13	12
1107	240
369	8
4797 *N.*	1920 *D.*

In this example the multiplying by 1 is omitted for the reaſon given in *page* 179.

Anſ. $\frac{4797}{1920}$ $=$ £2 9*s* 11*d* $\frac{5}{8}$

Example 2.

What principal will gain £40 in 8 months at 5 *per Cent per* annum?

First by *Reduction* 8 months $=$ $\frac{8}{12}$ $=$ $\frac{2}{3}$ of a year

Then as * $\frac{5}{1}$ — $\frac{100}{1}$ — $\frac{40}{1}$

$\frac{2}{1}$ — $\frac{3}{2}$ *

100	5
40	2
4000	10 *D.*
3	
12000 *N.*	

Anſw. $\frac{12000}{10}$ $=$ £1200

Or by two ſtatings thus,

* $\frac{5}{1}$: $\frac{100}{1}$ :: $\frac{40}{1}$

100
40
5) 4000
£ 800

* $\frac{1}{1}$: $\frac{800}{1}$ :: $\frac{2}{3}$ *

$\frac{2}{3}$) $\frac{800}{1}$ ($\frac{2400}{2}$ $=$ £1200 as before.

Note. This laſt ſtating is in *Reciprocal Proportion*,

Exam-

EXAMPLE 3.

If 12 men ſpend £20 in 9 months, how much will ſerve 16 men 18 months?

Firſt by *Reduction* 9 months $= \frac{9}{12} = \frac{3}{4}$ of a year, and 18 months $= 1\frac{1}{2}$ year $= \frac{3}{2}$. *Then*

men

As * $\frac{12}{1}$ —— $\frac{20}{1}$ —— $\frac{16}{1}$

* $\frac{3}{4}$ —— $\frac{3}{2}$

20	2
16	12
320	24
3	3
960	72 *D.*
4	
3840 *N.*	

Anſwer $\frac{3840}{72} = \frac{160}{3}$

£53 6*s* 8*d*

SCHOLIUM.

Having ſo copiouſly elucidated every difficulty that can poſſibly occur in *Vulgar Fractions*, I ſhall now preſent my readers with two *uſeful and curious articles* therein, ſent me by the *truly ingenious* Mr. *Nathaniel Brownell* teacher of the Mathematics in *Coventry Warwicſhire*.

Curious Articles in VULGAR FRACTIONS.

ARTICLE 1.

TO expreſs the proportion *that any* one, two, three *or* more fractions *have one to* another *in whole numbers.*

1. If it be required to know, what proportion the numerator bears to the denominator of any fraction, if it be a compound one, you muſt reduce it to a ſingle one, and then reduce it to its loweſt terms, and the numbers expreſſing the fraction ſo reduced, will be

be the numbers ſought. But if the fraction given be a ſingle one, whether proper or improper, you have nothing to do but reduce it to its loweſt terms, and the new fraction is the anſwer ſought. So if the queſtion was made by a mixt number, firſt reduce it to an improper fraction, in its loweſt terms, and the numerator and denominator ſo reduced is the anſwer.

2. If the given fractions have a common denominator, then the numerators are the whole numbers that expreſs the proportion, and if they can be reduced lower, you may do it as in the following example.

EXAMPLE 1.

What are the whole numbers that expreſs the proportion of $\frac{3}{7}$ to $\frac{6}{7}$?

Here rejecting the common denominator, the anſwer will be 3 and 6, *i. e.* the two given fractions will have the ſame proportion to one another, as the whole numbers 3 and 6 have to one another, and as 3 and 6 may be divided by 3, the quotients 1 and 2, will ſhew the proportion to be as 1 is to 2.

3. If the given fractions have not a common denominator, then reduce them to fractions that have a common denominator, and work as above.

EXAMPLE 2.

What proportion have $\frac{2}{3}$ to $\frac{1}{5}$?

The fractions when reduced to a common denominator will be $\frac{10}{15}$, and $\frac{3}{15}$, ſo that their proportion is as 10 to 3, which are numbers prime to one another, becauſe they cannot be reduced any lower, or have no other common diviſor but unity.

EXAMPLE 3.

What proportion is between $\frac{2}{3}$ of $\frac{5}{6}$ of $\frac{9}{13}$?

Anſwer. The numerator is to the denominator, as 5 to 13, for having reduced the compound fraction

to

to a ſimple one, it comes to $\frac{90}{234}$; which reduced to its loweſt terms becomes $\frac{5}{13}$, ſo that the whole numbers 5 and 13, are the whole numbers that expreſs their true proportion in the loweſt terms.

EXAMPLE 4.

Expreſs the proportion of $\frac{8}{18}$ in its loweſt terms, in whole numbers.

$\frac{8}{18}$ abbreviated becomes $\frac{4}{9}$; ſo that the fraction is as 4 to 9.

EXAMPLE 5.

What's the proportion of $\frac{7}{9}$ in whole numbers?

This being a fraction whoſe numerator is prime to its denominator, the anſwer in whole numbers is as 7 to 9.

EXAMPLE 6.

Expreſs in whole numbers the proportion of $\frac{25}{7}$ to $\frac{26}{5}$.——The fractions in their loweſt terms become $\frac{1}{3}$ and $\frac{13}{10}$ which being reduced to a common denominator, are $\frac{10}{30}$ and $\frac{39}{30}$.

Now rejecting, or throwing away the common denominator, the numerators not admitting of a common diviſor, or of being reduced any lower, the ſaid numerators are the numbers ſought, *viz.* the given fractions are in proportion to one another as 16 to 39.—After the ſame manner you may proceed with 3, 4, 5, or any other number of given fractions.

ARTICLE 2.

It will be convenient and uſeful in fractions *to know*

1. That if the difference between the numerator and denominator be an unit, and the fraction be either proper or improper, you need not to multiply by the numerator at all, but only divide by the denominator; and if the denominator be leſs than the numerator, add, or otherwiſe ſubtract that quotient to, or from the given number, and the ſum or difference will be the anſwer.

2. Or

2. Or if the difference between the numerator and denominator be more than an unit, multiply the given number by the ſaid difference, divide that product by the denominator, and add or ſubtract the quotient to or from the given number, according as the denominator is bigger or leſſer than the numerator, and the ſum or difference is the anſwer.

3. From theſe two obſervations it is very evident that, if the diviſor *i. e.* the denominator be broken into two parts, as directed in ſhort diviſion, and the aforeſaid difference be either an unit bigger, or leſs than one of thoſe parts, you need not to multiply by the ſaid differenee, but only divide firſt by that part which differeth from the ſaid difference by an unit, and according as the ſaid difference is an unit more, or leſs than the ſaid part you muſt add or ſubtract, that quotient to, or from the given number, then you muſt divide that ſum or remainder by the other part of the denominator, and if the denominator be leſs than the numerator, add, or otherwiſe ſubtract that laſt quotient to, or from the given number, and the ſum, or remainder will be the anſwer.

4. Or if the difference of the numerator and denominator be an aliquot part of the denominator, there will be no occaſion either to multiply by the ſaid difference, or divide by the denominator, but only divide the given number by the denominator of ſuch aliquot part, and ſo add, or ſubtract that quotient to, or from the given number, and the ſum or remainder is the anſwer.

What is the $\frac{4}{5}$ parts of a Ship's cargo worth, the whole being valued at £2713 12*s*. 8*d*.?

	£.	*s*.	*d*.
5)	2713	12	8
Subtract	542	14	6 $\frac{1}{4}\frac{3}{5}$
Anſwer	2170	18	1 $\frac{1}{2}\frac{2}{5}$

EXAMPLE *to Obſervation the Second.*

What's the value of $\frac{27}{32}$ parts of an eſtate whoſe value is £364 16*s.* 8*d.*?

	£.	*s.*	*d.*
	364	16	8
			5
4)	1824	3	4
32 8)	456	–	10
Subtract	57	–	1 $\frac{1}{4}$
Anſw.	307	16	6 $\frac{3}{4}$

Here the difference between the numerator and denominator is 5, therefore I multiply by 5, and divide the product by the denominator 32, and becauſe the numerator is leſs than the denominator, ſubtract the quotient from the multiplicand, and the remainder is the anſwer.

Or without Multiplitation by the 3d. Obſervation.

	£.	*s.*	*d.*
4)	364	16	8
Add	91	4	2
8)	456	–	10
Subtract	57	–	1 $\frac{1}{4}$
Anſw.	307	16	6 $\frac{3}{4}$

Here becauſe 5, which I ſhould multiply by, is one unit more than 4, one of the aliquot parts of 32, I divide by 4, and add, then I divide the ſum by 8 and ſubtract.

EXAMPLES *to Obſervation the Fourth.*

What is the $\frac{105}{112}$ part of £51 12*s* 8*d*?

	£.	*s.*	*d.*
4)	51	12	8
4)	12	18	2
Subtract	3	4	6 $\frac{1}{2}$
Anſw.	48	8	1 $\frac{1}{2}$

In this example the difference between the numerator and denominator is 7, which is an aliquot part of the denominator, *viz.* $\frac{1}{16}$th, therefore I divide by 16, and ſubtract the quotient from the given number, becauſe the denominator is bigger than the numerator, and the remainder is the anſwer.

More EXAMPLES *for Exercise to the preceding Observations.*

1. Suppose *A* and *B* buy a parcel of yarn, which cost £486 16*s*. 4*d*. *A* to pay $\frac{5}{8}$ of the price, and *B* $\frac{3}{8}$ of the price, how much must each pay?
Answer *A* £304 5*s*. 2*d*. $\frac{1}{2}$, and *B* £182 11*s*. 1*d*. $\frac{1}{2}$.

2. *A* and *B* bought 74 *C*. 1 *qr* 15 *lb*. of cotton wool, which cost £376 4*s*. 9*d*. *A* to have $\frac{7}{12}$, and *B* $\frac{5}{12}$, how much wool must each man have, and what must each pay?

		C.	*qr.*	*lb.*
Answer { *A.* *B.* } must have {		43	1	15 $\frac{3}{4}$
		30	3	27 $\frac{1}{4}$

		£.	*s.*	*d.*
And must pay {		219	9	5 $\frac{1}{4}$
		156	15	3 $\frac{3}{4}$

3. Three merchants *A*. *B*. *C*. purchased a Ship and cargo, which cost £586 12*s*. 8*d*. *A*. was to pay $\frac{2}{5}$ *B*. to pay $\frac{3}{8}$, and *C*. the rest, what must each pay?
Answ. *A*. £234 13*s*. –*d*. $\frac{3}{4}$ $\frac{1}{5}$, *B*. £219 19*s*. 9*d*. and *C*. £131 19*s*. 10*d*. – $\frac{4}{5}$.

PROMISCUOUS QUESTIONS.

Question 1. By Mr. *Thomas Dilworth*.

Says *Jack* to his brother *Harry*, I can place *four threes* in such a manner, that they shall make just 34; can you do so?

Solution.

$$\begin{array}{r} 33 \\ \frac{3}{3} = 1 \\ \hline 34 \end{array}$$

Answer 33 $\frac{3}{3}$

Queſtion 2. From Mr. *Birks's* Arithmetic.

If the Scavenger's rate at $1d.\frac{1}{2}$ in the pound, comes to $6s.\ 7d.\frac{1}{2}$ where they ordinarily aſſeſs $\frac{4}{5}$ of the rent; what will the *King's* tax for that houſe be, at $4s.$ the pound, rated at the full rent?

Firſt by *Reduction* of *Vulgar Fractions* $1d\frac{1}{2} = £\frac{1}{160}$, $6s\ 7d\frac{1}{2} = \frac{159}{480} = \frac{53}{160}£$, and $4s = \frac{1}{5}£$.

Then ſay 1ſt, As $\overset{*}{\frac{£.}{\frac{1}{160}}} : \frac{£.}{\frac{1}{1}} :: \frac{£.}{\frac{53}{160}}$

$$\frac{1}{160}) \frac{53}{160} (\frac{8480}{160} = \begin{matrix} 4)\ £ \\ 53 \\ 13\frac{1}{4} \end{matrix} \Big\} = \begin{Bmatrix} \frac{4}{5} \\ \frac{1}{5} \end{Bmatrix} \text{ of the rent}$$

$£66\frac{1}{4}$ whole rent

2d. A $\overset{*}{\frac{1}{1}} : \frac{1}{5} :: 66\frac{1}{4} = \frac{265}{4}$

1		5	
265		4	
265	*N.*	20	*D.*

Anſw. $\frac{265}{20} = \frac{53}{4} = £13\ 5s.$

Queſtion 3. By Mr. *Randles*, *Ladies Diary* 1752.

A gentleman has an Orchard of fruit trees, $\frac{1}{2}$ of the trees bearing apples, $\frac{1}{4}$ pears, $\frac{1}{6}$ plums, and 50 of them bearing cherries, how many fruit trees in all grow in the ſaid Orchard?

The fractions in this queſtion *viz.* $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{6}$, reduced to a common denominator (by the *note* to *caſe* 9 *page* 251) make $\frac{6}{12}$, $\frac{3}{12}$, and $\frac{2}{12}$, whereby the whole number of trees is divided into 12 equal parts, whereof thoſe that bear apples are 6, pears 3, and plums 2, which added together make $\frac{11}{12}$, ſo that $\frac{11}{12}$ being all the trees except the cherries, it is evident (*the whole being divided into* 12 *parts*) that they muſt be the remaining $\frac{1}{12}$, which by the queſtion is equal to 50, then $\frac{1}{12}$ or the whole muſt be 12 times 50 = 600 the number

number of trees in the Orchard, and of which $\frac{6}{12}$ or $\frac{1}{2}$ bear apples = 300, $\frac{3}{12}$ or $\frac{1}{4}$ pears = 150 and $\frac{2}{12}$ or $\frac{1}{6}$ plums = 100 ſo that the number of each ſort will be as under *viz.*

Of thoſe that bear	Apples	300	
	Pears	150	
	Plums	100	
	Cherries	50	
Total number		600	as in the preceding *page.*

Queſtion 4. By Sir *Iſaac Newton.* See his Univerſal Arithmetic.

Three workmen can do a piece of work in certain times, *viz.* *A* can do it in 3 weeks, *B* can do thrice the work in 8 weeks, and *C* five times in 12 weeks; in what time can they finiſh it jointly?

It is evident by the queſtion (or may *very eaſily* be found by the *Rule of Three*) that *A* can do $\frac{1}{3}$, *B* $\frac{3}{8}$ and *C* $\frac{5}{12}$ of the work in *one week*, which fractions being reduced to a common denominator (ſee the *note* to *caſe* 9 *page* 251) make $\frac{8}{24}$, $\frac{9}{24}$ and $\frac{10}{24}$ whoſe ſum is $\frac{27}{24} = \frac{9}{8}$ being the work that they can do when all are working together *one week*, Then

work days work

If $\frac{9}{8}$: $\frac{6}{1}$ :: $\frac{1}{1}$

$\frac{9}{8}) \frac{6}{1} (\frac{48}{9} = \frac{16}{3} = 5\frac{1}{3}$ days anſwer

The following queſtion was ſent me (with ſome others,) by the ingenious Mr. *Iſaac Gumley* of *Counteſthorpe* near *Leiceſter*, and as it ſeems to be a pretty piece of entertainment for my fair readers, ſhall give it a place in this book.

Queſtion 5. By Mr. *Iſaac Gumley.*

Says *John* a homely country *ſwain*,
To *Nan* the glory of the plain,
On whom he'd fix'd his love;
Dear *Nancy* name the happy day,
When thou wilt give thyſelf away,
And all my doubts remove.

2.

O ſay when thou at Church wilt ſtand,
And give to me thy lovely hand,
And make me truly bleſt;
My charming maid, O! let me know,
When my fond heart with joy ſhall glow,
Which finds but little reſt.

3.

Dear *John* ſays ſhe I love you well,
And think you all the ſwains excel,
In beauty and good ſenſe;
Then anſwer me this queſtion pray;
And thou wilt find the happy day,
When I'll the boon diſpenſe.

4.

One ſixth, one fourth, * when join'd to *four*,
Will give the day, leſs *half a ſcore*,
The day o'th' month I mean;
So now prepare the gloves and ring,
And be as happy as a king,
And I will be your queen.

5

But *John* has try'd and try'd again,
Until he's almoſt crack'd his brain,
Yet cannot find it out;
Then help him O ye *ſwains* of art,
To find the day and eaſe his heart,
And baniſh ev'ry doubt

---

* $\frac{1}{6}$, $\frac{1}{4}$ of the day of the month. *Solution*

Solution.

First the fractions $\frac{1}{6}$ and $\frac{1}{4}$ added together make $\frac{5}{12}$, *Then* (it is evident by the question that) $\frac{5}{12} + 14 = \frac{12}{12}$ or the whole.—Now the following being a self evident Axiom *viz. if from equal things an equal quantity be taken away, the remainders will be equal to each other*, therefore by subtracting $\frac{5}{12}$ from each side of the above equation, it will be $\frac{7}{12} = 14$. Then as 7 : 14 :: 12 : 24 the answer.

On the *twenty-fourth* day young *Johnny* will find,
The delights of a *Fair*, who is virtuous and kind.

DECIMAL FRACTIONS.

*JOHN Muller** as some authors† say,
Invented first this curious way,

Of

---

* Otherwise called *Regiomontanus*.

† *Malcolm*, *Potter* &c. But Mr. *Ward* seems at an uncertainty who was the first Inventor.

Mr. *Malcolm* in his history of Arithmetic *page* 18, says that "*Regiomontanus* about the year 1464, is "the first we know who in his *Triangular Tables* di-"vided the Radius into 10,000 parts instead of "60,000; and so tacitly introduced Decimal parts "in place of *Sexagesimals*, *Ramus* in his arithmetic "written about 1550, (and published by *Lazarus* "*Schonerus* in 1586) uses Decimal periods in car-

Of working ſums by equal parts,
To ſhine conſpicuous in the arts;
By *Decimals* all Fractions are,
With freedom wrought and made out clear.
By eaſy rules juſt to your mind,
Heights, depths, and diſtances you find,
You traverſe by their well known aid,
To things ſublime—by learning made
To ſoar above, where planets roll,
And meaſure true from pole to pole,
Then *Tyro* haſte, judicious be,
And ſoon their excellence you'll ſee.

Notation of Decimals.

By *Decimals* you are to underſtand, that the Integer or unit (be what it will) is ſuppoſed to be divided into 10 equal parts, and every one of thoſe parts into 10 other equal parts, and ſo on by a continual ſubdiviſion, and are ſeparated diſtinguiſhed or known from Integers, by a point or dot placed to the left hand of the fractional parts or numbers, (be what they will) without their denominators, for as dividing a number by 10, 100, 1000 &c. is only ſeparating ſo many of the right-hand figures from the reſt, as there are ciphers in the diviſor (ſee *page* 116) therefore decimal denominators need not be wrote, as eaſily underſtood to be *unity* with as many ciphers annexed as are equal to the number of figures, ſeparated or pointed off to the right-hand.

" rying on the extraction of Square and Cube Roots " to Fractions. The ſame did our Country-man " *Bucklaus* before *Ramus;* and *Record* about the " ſame time. But the firſt who wrote an expreſs " treatiſe of Decimals, was *Simon Stevinus,* about " 1582." *Thus*

Thus

The Fraction $\frac{7}{10}$ $\frac{67}{100}$ $\frac{514}{1000}$ $\frac{6}{10}$ $\frac{6}{100}$ $\frac{6}{1000}$ is wrote without its denominator 7.4, 67.54, 8.514, .6, .06, .006 and signifies 7 units & 4 tenth, 67 units & 54 hundreth, 8 units & 514 thousandth } parts of an unit. 6 tenth, 6 hundredth, 6 thousandth } parts of an unit.

So that

It is obvious that if a numerator does not consist of as many figure as there are ciphers in its decimal denominator, the defect must be supplied by prefixing a cipher or ciphers to (the left hand of) the numerator, and that every cipher so placed or prefixt, makes the decimal to signify but a tenth part of what it did.

for .006 } is but one tenth part of } .06 But ciphers annexed to the numerator of a deci-
and .06 } .6 mal, also supposes a like number to be annexed to the denominator, and therefore multiplies both by the same number, which does not alter the value of the fraction,

Thus

Thus $\left\{\begin{matrix}.8\\.80\\.800\end{matrix}\right\}$ ſignifies $\left\{\begin{matrix}\frac{8}{10}\\\frac{80}{100}\\\frac{800}{1000}\end{matrix}\right\} = \frac{4}{5}$ *Hence* it is manifeſt that ciphers placed to the right hand of a decimal, neither augment nor diminiſh its value, and therefore may be annexed to, or rejected from, the right hand of decimals at pleaſure.

ADDITION IN DECIMALS.

RULE.

AS in whole numbers write directly,
Your figures down moſt circumſpectly,
The units under units place,
And point them off with reg'lar grace,
Then add them up as taught before,
And you'll the ſum with eaſe explore.

Exam. 1.	Exam. 2	Exam. 3.	Exam. 4.
1.46	5.4167	861.4	567
27.678	.9001	56.59	14.1419
.416	71.006	3.1	.8167
514.3	4.12	51.691	5.4
An. 543.854	81.4428	972.781	587.3586

Exam. 5.	Example 6.
.4167	To 15.9463
.0141	Add $\left\{\begin{matrix}79\\8\\57\end{matrix}\right\}$ of $\left\{\begin{matrix}\text{a hun.}\\\text{a tho.}\\\text{10 tho.}\end{matrix}\right\} = \left\{\begin{matrix}15.9463\\.79\\.008\\.0057\end{matrix}\right.$
.9815	
.3017	
An. 1.714	Anſwer 16.75

SUBTRACTION

SUBTRACTION IN DECIMALS.

RULE.

AS in whole numbers you proceed—
To point as taught before take heed
A leſſer from a greater take,
And you'll the diff'rence quickly make.

EXAM. 1.	EXAM. 2.	EXAM. 3.	EXAM. 4.
From .8141	1.4165	734 15	14.
Take .7691	.346	641.739	.9146
Rem. .045	1.0705	92 411	13.0854
Proof .8141	1.4165	734.15	14.

MULTIPLICATION IN DECIMALS.

RULE.

AS in whole numbers multiply
Your factors true continually,
Point off what decimals there be,
In both the factors, then you'll ſee,
Your product wrought compleat and fair,
As quickly will be made t' appear.

Note. If there be not ſo many figures in the product as there are decimals in the factors, a cipher or ciphers muſt be prefixt to ſupply the defect.

EXAM-

EXAMPLE 1.		EXAMPLE 2.	
Multiply	141.14	Multiply	7.4587
By	...5.46	By	.00876
	84684		447522
	56456		522109
	70570		596696
Product	770.6244	Product	.065338212

In example 2 there are 9 places of decimals in the factors, and but 8 figures in the product, therefore a cipher is prefixt to ſupply the defect.

EXAMPLE 3.

Multiply 54.567

By 10

Product 544.67 †

† *Hence* it is plain that *to multiply any decimal fraction or mixt number by an unit with any number of ciphers annexed*, is only removing the decimal point ſo many places farther to the *right hand*, as there are ciphers in the multiplying factor and ſubjoining ciphers if need be. So if 78.54 were to be multiplied

By	will be the prod.
10	785.4
100	7854.
1000	78540.
10000	785400.

Multiply 75 4678

By 6.05408

60	37424
3018	7120
37733	90
4528068	0

Prod. 456.8880|98624*

* In this product you ſee there are 9 places of decimals, but as in moſt caſes 3 or 4 are ſufficient, it is therefore very neceſſary to become acquainted with the following moſt uſeful Con-

CONTRACTION

To multiply any given factors, and have in the product any desired number of Decimal parts less than the whole of such parts.

RULE.

Under the multiplicand place the multiplier in an inverted order, so that its unit figure (before inverted) may stand under that place of parts in the multiplicand, as you would have the last figure of the product to be, then in multiplying reject all the figures in the multiplicand which are on the right of the figure you are multiplying by, placing the products so, that their right hand figures may fall straight below each other, and carry to such right hand figures from the product of the 2 next rejected multiplicand figures thus, *viz.* 1 from 5 to 15, 2 from 15 to 25, 3 from 25 to 35, &c. and the sum of the lines will be the product to the number of decimal places required, and will be seldom wrong in the last figure.

EXAMPLE 1.

Multiply 75.4678 by 6.05408 so as to retain only 4 places of decimals in the product (see this example worked at large in the preceding *page*)

Multiplicand	75.4678
Mult. inverted	80450.6
	4528068
	37734
	3019
	60
Product	456 8881

EXAMPLE 2.

Multiply 6.485676
By 4587.0 so as to retain 3 places of decimals

Multiplicand	6.485676
Mult. inver.	4587.0
	4540
	519
	32
	2
Product	5.093

EXAMPLE 7.

Multiply .68479
By .0765 to have 5 places of decimals in the product.

.68476
5670.0

4793
411
34

Product .05238

Note. As *this contraction* and *that* which follows in diviſion are quite practical and facile, and anſwer the ſame end as the method of *Recurrents* or *Circulating Decimals* doth, therefore to have treated on them wou'd certainly have been ſwelling this treatiſe to no manner of purpoſe but curioſity only. See *page* 193 of *Birks's* arithmetic, where that author ſays, they are more curious than uſeful.

DIVISION IN DECIMALS.

RULE.

AS in whole numbers you divide,
Obſerve this uſeful hint beſide,
What decimals your dividend,
Exceeds th' diviſor, then my friend,
Cut from the quote that number true,
The decimal appears to you,
As the annext examples ſhew.

Note. If the quotient does not contain a ſufficient number of figures to be pointed off, the defect muſt be ſupplied by prefixing cyphers thereto.

EXAMPLE

EXAMPLE 1.

Divide 55.37376 by 4.176.

```
4.176) 55.37376 (13.26
       41 76
       ------
       13 613
       12 528
       ------
        1 0857
          8 352
        -------
          2 5056
          2 5056
          ------
                0
```

In this example the number of decimal places in the dividend, exceeds thoſe in the diviſor by 2, therefore that number of decimals is pointed off in the quotient.

EXAMPLE 2.

Divide 4.68 by 123.45.

```
123.45) 4.6800 (.03791
        3 7035
        -------
          97650
          86415
          -----
          112350
          111105
          ------
            12450
            12345
            -----
              105
```

When any dividend contains fewer figures than its diviſor, a competent number of ciphers muſt be annexed after the decimal point in the dividend, to make it contain the diviſor ſome number of times leſs than 10, and as you proceed a cipher muſt be ſubjoined to each remainder, till the dividend is continued to a ſufficient number of decimal places.—In this example the dividend is continued to 7 places of decimals, which being 5 more than thoſe in the diviſor, therefore a cipher is prefixt to the quotient as not otherwiſe containing figures enow to be pointed off, to make it conſiſt of that number of decimals.

EXAMPLE 3.

Divide .078246 by .042

```
.042) .078246 (1.863
      42
      ---
      362
      336
      ---
       264
       252
       ---
        126
        126
        ---
          0
          -
```

EXAMPLE 4.

Divide .45674 by 82.

```
82) .45674 (.00557
     410
     ---
      467
      410
      ---
       574
       574
       ---
         0
         -
```

In this example there being 5 places of decimals in the dividend, and none in the diviſor, therefore 2 ciphers are prefixt to the quotient to make it conſiſt of its proper number of decimal places.

EXAMPLE 5.

Divide .75£ by .0125.£

```
.0125) .7500 (60£
       750
       ---
         .0
         --
```

In this example the number of decimal places in the dividend being (by annexing 2 ciphers) made equal in number to the decimals in the diviſor, therefore 60 the quotient is a whole number.—This example is the ſame as if it were required to divide 15*s* by 3*d*, a pound being the Integer, for the decimal

mal of 15*s* is 75*£* and that of 3*d*, .0125*£* as will be eaſily known when you underſtand *Reduction of Decimals*. Hence it is manifeſt that

As *Multiplication* / So *Diviſion* } of fractions { *decreaſeth* their value / *increaſeth* it, contrary

in both to the nature of Integers.

Example 6.

Divide 987.65 by 100.

100) 987.65

9.8765 Quotient, whereby it is plain that *to divide any decimal fraction or mixt number by an unit with a cipher or ciphers annexed*, is only removing the decimal point in the dividend ſo many places farther to the *left hand* as there are ciphers in the diviſor, prefixing ciphers to the dividend if need be.

Thus

88.62 divided by { 10 / 100 / 1000 / 10000 } quotes { 8.862 / .8862 / .08862 / .008862 }

From what has herein before been ſaid relating to Diviſion it may be eaſily obſerved that the firſt figure of every quotient (as well in Diviſion of Integers as Decimals) muſt poſſeſs the ſame place (with reſpect to its value) as that figure of the dividend doth, which ſtands over the unit's place of the firſt figure's product and which is an eligible Rule *to value quotients* obtained by the following uſeful

Contraction

When the diviſor conſiſts of many figures the diviſion at large will be troubleſome, but may be much abbreviated by the following

RULE.

Reject as many of the right hand figures in the diviſor as will make it conſiſt of the ſame number of figures there is to be in the quotient, obſerving to carry from ſuch rejected figures as directed in the contraction of Multiplication *page* 287 and inſtead of taking down a figure from the dividend to each remainder, point off a figure each time from the right hand ſide of the diviſor till it be exhauſted, but if the diviſor does not conſiſt of as many figures as there are to be in the quotient, work with the whole diviſor the uſual or common way till the defect is ſupplied, and then proceed as above directed.

EXAMPLE I.

Divide 423.68946 by 59.6874:

Contracted Method

59.687|4) 423.68946 (7.0984
417812
5877
5372
505
477
28
24
4

In this example one figure is cut off from the diviſor, becauſe it contains 1 more than was to be found, and as 3 the units place of the dividend, ſtands over 7 the units place of the firſt figure's product, therefore the firſt figure in the quoient is units.

Common Method.

59.6874) 423.68946 (7.0984
417811|8
5877|660
5371|866
505|7940
477|4992
28|29480
23|87896
24|41584

EXAMPLE

EXAMPLE 2.

Divide 69.7482 by 84.5 ſo that the quotient may contain 4 decimals.

```
84.5) 69,7482 (.8254
      67 60
      -----
       21 48
       16 90
       -----
        45 8
        42 3
        ----
         3 5
         3 4
         ---
           1
           -
```

EXAMPLE 3.

Divide .045768 by .9874

```
0.9874) .045768 (.04635
    ...   39496
          -----
           6272
           5924
           ----
            348
            296
            ---
             52
             49
             --
              3
              -
```

In the ſecond example one figure is taken down from the dividend, becauſe the diviſor contains one figure leſs than what is required to be in the quotient, and as 7 the *firſt place of Decimals* in the dividend, ſtands over 6 the units place of the firſt figure's product, therefore 8 the firſt figure in the quotient is in the *firſt place of Decimals*.—And in the 3d example the *ſecond place of Decimals* in the dividend *viz.* the figure 4 ſtands over 3 the units place of the firſt figure's product, therefore a cipher is prefixt to the figure 4 in the quotient, to make it poſſeſs the *ſecond place* alſo.

REDUCTION IN DECIMALS.

CASE 1.

To reduce any Vulgar Fraction *to an equivalent* Decimal *one.*

RULE.

FIRST to the numerator add
Cyphers at pleaſure,—then is had
Your decimal,—if you divide
By th' denominator true beſide.

EXAMPLE I.

One third of a unit diſcover to me,
In decimal parts and with truth to agree.

3) 1.0000

.3333 &c. *ad infinitum.*

EXAMPLE 2.

Reduce $\frac{13}{145}$ to a Decimal.

145) 13.00 (.089
1160

1400
1305

950
870

80

EXAMPLE 3.

Reduce $\frac{1}{2}$ of $\frac{3}{5}$ of $\frac{5}{8}$ to a Decimal.

Firſt the compound fraction $\frac{1}{2}$ of $\frac{3}{5}$ of $\frac{5}{8}$ reduced to a ſimple one becomes $\frac{15}{80}$ *Then*

80) 15.0000

.1875

Note. It frequently happens that Decimals will not terminate, but that there will ſtill be a remainder (as in this example) but if the decimal be continued to 4 or 5 places, it will be exact enough in moſt caſes, and the remainder may be ſafely rejected as being ſo very inconſiderable.

EXAMPLE

EXAMPLE 4.

Reduce me this fraction * to decimal parts *$\frac{5}{16}$
And you ſhall arrive to be maſter of arts.

16 { 2) 5.0
     8) 2.5

Anſwer .3125

CASE 2.

To reduce the parts of money, weights, meaſure &c. *to a* Decimal.

RULE 1,

Reduce the parts to the loweſt denomination given and expreſs them as a vulgar fraction making the Integer (when reduced to the ſame name) the denominator. But *Note* if the given number be a ſimple one it needs no preparation, for it will be the numerator, and the Integer (in the ſame name) the denominator, with which vulgar fraction proceed as directed in the preceding *page*.

RULE 2.

Place the numbers of the ſeveral denominations under each other beginning with the leaſt, and divide each by ſuch a number that will raiſe it to the next ſuperior name (as directed in *Reduction of Integers*) placing each quotient as a Decimal part of the next dividend before it he divided, and the final quotient will be the anſwer.

EXAMPLE 1.

Reduce 18*s* 6*d* $\frac{3}{4}$ to the decimal of a pound Sterling.

SOLUTION

SOLUTION *by*

Rule 1.

First 18*s* 6*d* $\frac{3}{4}$ = 891 *qrs*
Then 891 *qrs* = $\frac{891}{960}$ of a £ which fraction reduced by *Case* 1 *page* 294, makes .928125 £ the decimal required.

Rule 2.

4	3.0	
12	6.75	
2|0	18.5625	
An. £	.928125	

By this method, first the 3 farthings are reduced to the decimal of a penny, then the 6.75 pence to the decimal of a shilling, and lastly the 18.5625 shillings to the decimal of a pound.

EXAMPLE 2.

Reduce 15*s* to the decimal of a pound.

First 15 = $\frac{15}{20}$ of a £.

Then (*by Case* 1 *page* 294)

2|0) 15.0

Answ. £.75

EXAMPLE 3.

Reduce £4 15*s* 7*d* $\frac{1}{2}$ to the denomination of pounds.

2	1.0
12	7.5
2|0	15.625
Anſ. £	4.78125

EXAMPLE 4.

Reduce 18*s* 6*d* to the decimal of a pound.

12	6.0
2|0	18.5
Anſw. £	.925

EXAMPLE 5.

What decimal part of a pound tell me true
Is ſix-pence.—This *Tyro* you'll preſently do,
And ſhine with *Minerva*, in her fine retreat,
Where *Newtons*, *Boyles*, *Hallys* and *Emerſons* wait.

Firſt

First 6*d* = $\frac{6}{240}$ of a £.

Then (*by Case* 1 *page* 294)

240) 6.00 (.025 Anſw.
480

1200
1200

Or agreeable to *Rule* the 2d, thus

12|6.0
2|0|0.5

£.025

EXAMPLE 6.

Reduce 36 poles to the decimal of an acre.

40|36.0
4| 0.9

Anſw. .225

EXAMPLE 7.

Reduce 4*C*. 3*qrs*. 8*lb*. to the decimal of a tun.

28 { 4|8.
{ 7|2.0
4|3.285714+
2|0|4.821428+

Anſw. .2410714+

EXAMPLE 8.

Reduce 15 dwt. 12 grs. to the decimal of an ounce Troy.

24 { 3|12
{ 8| 4.0
2|0|15.5

Anſw. .775

EXAMPLE 9.

Reduce 3 inches to the decimal of a yard.

12|3.0
3|0.25

Anſw. .0833 &c.

Theſe examples being well underſtood are ſufficient to ſhew how to reduce any parts of other weights, meaſures, &c. into decimals, therefore ſhall now proceed to

CASE

CASE 3.

To find the value *of any* Decimal Fraction *in the known parts of the Integer.*

RULE

Multiply the given decimal by the known parts of the next inferior denomination, and point off in the product as many places of decimals as there are in the given decimal fraction, then reduce the decimal produced, to the next inferior name, pointing off the product as before, and so proceed to the least known denomination or as far as necessary, and the figures on the left hand the dots or points will be the value required.

EXAMPLE 1.

I'th' parts in the margin * come *Tyro* unfold, * 26875
The value, be't copper, be't silver or gold. parts of a £

	£.
	.26875
	20
s	
	5 375
	12
d	
	4·5
	4
	½. 0
Answ.	5*s* 4*d* ½

EXAMPLE 2.

What is the value of .845 Cwt. ?

	.845
	4
qrs.	3.38
	28
	304
	76
lb.	10.64

EXAMPLE 3.

What is the value of .928125 £ ?

	20
s	
	18.5625
	12
d	
	6·75
	4
	¾ 0

EXAM-

EXAMPLE 4.

Now *Tyro* advance learn the *Decimal* art,
In ſurveying eſtates you'll then ſoon take a part,
Come tell me the parts in the margin * ſubjoin'd, *.8375
Of an acre of land roods and poles, both combin'd,
Come do this thing clearly, no doubt very ſoon,
You'll be a Surveyor, and meaſure the moon.

.8375
4
3.35
40
14.0
An. 3 rds. 14 pls.

EXAMPLE 5.

What is the value of. 8146 hhd.

63
24438
48876
A. 513198 gal.

EXAMPLE 6.

What is the value of. 775 oz. Troy.

.775
20
15.5
24
120
A. 15dwt. 12grs.

CASE 4.

To find the value *of any* Decimal *by* inſpection, *a pound Sterling being the Integer.*

RULE

Double the figure in the firſt place of the given decimal (*viz.* that figure next to the units) for ſhillings, and if the figure in the 2d place be 5 or more, then add 1 to the double of the firſt figure, and the 2d figure if under 5 or the exceſs if above 5 prefix to the 3d figure and reckon 'em as farthings, abating 1 when they are above 25 and 2 when above 40.

EXAMPLE

EXAMPLE 1.

What is the value of .26875£?

The first figure doubled with 1 added (because the 2d figure is more than 5) is 5*s*. then 1 (the second figure's excess above 5) prefixt to 8 the third figure makes 18 farthings, *viz.* 4*d* $\frac{1}{2}$ so that the value is 5*s* 4*d* $\frac{1}{2}$ the same as in *page* 298.

EXAMPLE 2.

What is the value of .928125£?

The 9 doubled is 18*s*, and the 2 next figures *viz.* 28, abating 1 (as they are more than 25) make 6*d* $\frac{3}{4}$ therefore the value is 18*s* 6*d* $\frac{3}{4}$ the same as in *page* 298.

EXAMPLE 3.

What is the value of 846£?—The 8 doubled is 16*s*, and 46 farthings abating 2 are 11*d*, therefore the value is 16*s* 11*d*

Amusing Questions.

Question 1.

In the 2d book of *Samuel* Chap. 14. we read that *Absalom* cut off the hair of his head every year, and that it weighed 200 half ounce Shekels. What was the weight in pounds and decimal parts of a pound.

First 200 Shekels or half ounces = 100 ounces

Then

$$16\left\{\begin{array}{l}2)\ 100\\ \hline 8)\ 50\end{array}\right.$$

Answer 6.25 = 6*lb.* $\frac{1}{4}$

Question

Queſtion 2.

Goliah's great gigantic ſize,
Six cubits * and a ſpan, †
He led his hoſt with glaring eyes,
Cry'ng chuſe me out the man,
Who dares in ſingle combat fight
Me,—let him try his ſkill,
For I defy each *Iſr'elite*,
His ſtrength be what it will.
With glitt'ring helmet on his head,
Well arm'd with *Coat of Mail*,
Which juſt five thouſand Shekels ‡ weigh'd,
His threats rang thro' the vale,
A brazen target on his breaſt,
Like poſts § his legs did ſeem,
And his huge ſpear among the reſt,
Was like a weaver's beam.
Whoſe head when weighed true we find
Six hundred Shekels more,
Enough to daunt young *David*'s mind,
Then *Tyro* pray explore,
This Bravo !—This *Philiſtine*'s height
In *Britiſh* meaſure true,
And likewiſe tell his *Coat*'s true weight
In pounds—and *Spear*'s head too.

---

* Of 1 foot 9.888 inches according to Dr. *Arbuthnot*.

† Half a cubit.

‡ Of ½ an ounce Avoirdupoiſe.

§ Alluding to the greaves of braſs upon his legs.

21.888 inches in one cubit
6.5 number of cubits

109440
131328

12) 142.272 } height in { inches
3) 11.856 } { feet
3.952 { yards

Then by proceeding as in the laſt queſtion the 5000 Shekels (or half ounces) *the weight of his coat*, will be found to be 156*lb.* $\frac{1}{4}$ = 1*C.* 1*qr.* 16*lb.* 4*oz.* and the 600 Shekels (or half ounces) *the weight of his Spear's head* 18*lb.* $\frac{3}{4}$

Queſtion 3.

Og king of *Baſhan*—ſcripture ſays
His Iron bedſteads were
In length nine cubits, and the breadth
Was four—it does appear,
The length and breadth I pray unfold,
In *Britiſh* meaſure true,
And area of this Giant's bed,
All this with eaſe you'll do.

Firſt 9 and 4 } cubits, the { length / breadth }
multiplied into 1.824 foot (the length of a cubit)
produces 16.416 and 7.296 } the { lth. / bth. } of the bedſteads in feet.

Then (according to the rule at the bottom of *page* 80 for finding the area of a rectangular figure) 16.416 multiplied by 7.296 produces 119.771136 the area in feet, which divided by 9 (the ſquare feet in a ſquare yard) quotes 13.3 + the area in yards.

The

The RULE of THREE in DECIMALS.

RULE.

IN *Decimals* the *Rule of Three*,
As *Integers* muſt worked be,
Your vulgar fractions turned fair
To Decimals,—then next prepare,
To ſtate and work as taught before,
And you'll the anſwer ſoon explore.

EXAMPLE 1.

When two eighths of a pound coſt three fourths of a ſhilling,
The price of four fifths you may find if you're willing.

The vulgar fraction $\frac{2}{8}\ \frac{3}{4}\ \frac{4}{5}$ = .25 .75 .8

Then as

lb.	*s.*	*lb.*
.25	.75	.8
	.8	
	s	
.25)	.600	(2. 4
	50	12
		d
	100	4.8
	100	4
	0	$\frac{3}{4}$.2

Anſwer 2*s* 4*d* $\frac{3}{4}$

EXAMPLE 2.

In a rich *copper mine* we find,
Three fifths was *Jacob*'s ſhare,
Who ſold to bonny *Kate* ſo kind,
Three fourths it does appear;
For ſeventeen hundred and ten pound,
Of this his right thereto,
What was his ſhare * I pray expound,
Come *Tyro* tell me true.

* Intereſt in the *mine*.)

Firſt $\frac{3}{4}$ of $\frac{3}{5} = \frac{9}{20} = .45$ being that part of *the whole* which he ſold for £1710.

Then If .45 : £1710 :: .75 = $\frac{3}{4}$

	.75
	8550
	11970
.45 {	.5) 1282.50
	.9) 2565.0

From	£2850	the value of his	original	share
Take	1710		alienated	
Rem.	1140		preſent	

Or divide £1710 by .45 and the quotient will be £3800 the value of the whole mine, from $\frac{3}{4}$ of which *viz.* £2850 deduct £1710 and the remainder will be £1140 the value of his preſent ſhare, the ſame as above.

Example 3.

Suppoſe 12 men mow down a field of graſs in 5 $\frac{3}{4}$ days, how many men (at the ſame rate of working) will mow down the ſame in 3 days?

Reciprocally as 5 $\frac{3}{4}$ = 5.75 : 12 :: 3 days : men : days

12

3) 69

Anſwer 23 men

The

The *Rule of Three* in decimals (respect being had to the pointing) being exactly the same as *that* in Integers, wherein I have given such variety of examples makes it quite unnecessary to give any more in the *Rule of Three* in this place, so shall now give a few examples in the rule of *Practice* by decimals, and then proceed to treat of the *Square* and *Cube Roots*.

PRACTICE IN DECIMALS.

INGENIOUS *Tyro* here you see,
How useful decimals must be,
To all who are concern'd in trade,
All tradesmen sure might crave their aid,
Who wou'd with method quick and fair,
Keep their accompt-books just and clear.

EXAMPLES.

s d							
2 6	$\frac{1}{8}$	6783 yards at $\frac{1}{2}$			2d	$\frac{1}{12}$ | 0	774 at 1d
				s d			
$\frac{1}{2}$	$\frac{1}{6}$ | 0	847.875	pr. at	2 6	$\frac{1}{4}$	$\frac{1}{8}$	6.45
							.806
		14.13125		$-\frac{1}{2}$			5.644
		Answ. £14 2s 7d $\frac{1}{2}$					price at 2d $-\frac{1}{4}$ 1 $\frac{3}{4}$
							Answ. £5 12s 10d $\frac{1}{2}$
5s	$\frac{1}{4}$	5746*lb.* at $\frac{3}{4}$			s d		
				s d	2 6	$\frac{1}{8}$	714 at 2d $\frac{1}{2}$
$\frac{3}{4}$	$\frac{1}{8}$ | 0	1436.5	pr. at	5 $-$	d		
					$2\frac{1}{2}$	$\frac{1}{12}$	89.25
		17.956		$-\frac{3}{4}$			7.4375
		Answ. £17 19s 1d $\frac{1}{2}$					pr. at 2s 6d $-2\frac{1}{2}$
							Answ. £7 8s 9d

EXAMPLES.

3d	$\frac{1}{8}$|0	586.5 (= 586 $\frac{1}{2}$) at 2d. $\frac{3}{4}$		5s	$\frac{1}{4}$	876 at 10d	
$\frac{1}{4}$	$\frac{1}{12}$	7.3312	pr. at 3d.	d			
		.6109	$\frac{1}{4}$	10	$\frac{1}{6}$	219 price at 5s	
		6.7203	2 $\frac{3}{4}$			36.5 = £36 10s	
		Answ. £6 14s 4d $\frac{3}{4}$		1s	$\frac{1}{2}$|0	978 at 13d $\frac{1}{2}$	
s d				d			
2 6	$\frac{1}{8}$	785.75 (= 785 $\frac{3}{4}$) at 3d $\frac{3}{4}$		1 $\frac{1}{2}$	$\frac{1}{8}$	48.9	pr. at 1s −d
						6.1125	− 1 $\frac{1}{2}$
d			s d				
3 $\frac{3}{4}$	$\frac{1}{8}$	98.2187	pr. at 2 6			55.0125	1 1 $\frac{1}{2}$
		12.2773	3 $\frac{3}{4}$			Answ. £55 −s 3d	
		Answ. £12 5s 6d $\frac{1}{2}$		5s	$\frac{1}{4}$	156.25 (= 156 $\frac{1}{4}$) at 15d	
				s d			
6d	$\frac{1}{4}$|0	678 at 6d $\frac{3}{4}$		1 3	$\frac{1}{4}$	39.0625	pr. at 5s −d
$\frac{3}{4}$	$\frac{1}{8}$	16.95	pr. at 6d			9.7656	1 3
		2.1187	− $\frac{3}{4}$			Answ. £9 15s 3d $\frac{3}{4}$	
		19.0687	6 $\frac{3}{4}$	s d			
		Answ. £19 1s 4d $\frac{1}{2}$		1 8	$\frac{1}{12}$	795 at 17d $\frac{1}{2}$	
				d			
				2 $\frac{1}{2}$	$\frac{1}{8}$	66.25	pr. at s d
						8.281	1 8
							− 2 $\frac{1}{2}$
5s	$\frac{1}{4}$	754 at 7d $\frac{1}{2}$				57.969	1 5 $\frac{1}{2}$
d							
7 $\frac{1}{2}$	$\frac{1}{8}$	188.5	pr. at 5s −d			Answ. £57 19s 4d $\frac{1}{2}$	
		23.5625	7 $\frac{1}{2}$				
		Answ. £23 11s 3d					

EXAMPLES.

2s	$\frac{1}{10}$	157.25 (= 157 $\frac{1}{4}$) at 2s 2d			
2d	$\frac{1}{12}$	15.725	pr. at	2s – d	s
		1.310		– 2	10
		17.035		2 2	3 4
		£17 – s 8d $\frac{1}{2}$ Answ.			
		874.5 = (874 $\frac{1}{2}$) at 6s 8d			
8d	$\frac{1}{3}$	87.45 pr. at 2s			
		3			
		262.35	pr. at	6s –	
		29.15		– 8	
		291.5		6 8	
		Answer £291 10s			
s d		Or thus			
6 8	$\frac{1}{2}$	874.5			8
		291.5 = £291 10s			
		Answer as before			

		129 at £1 13s 4d		
		£		£ s d
	$\frac{1}{2}$	129	price at	1 – –
	$\frac{1}{3}$	64.5		– 10 –
		21.5		– 3 4
		£215		1 13 4

C. qrs. lb.
249 3 10 $\frac{1}{2}$ at £3 2s 8d *per C.* See this example in *page* 225. This weight reduced (by *Case* 2 *page* 295.) will stand thus

249.84375
3

			£ s d
		749.53125 at	3 – –
	$\frac{1}{3}$	24.984375	– 2 –
		8.328125	– – 8
		782.84375 at	3 2 8
		£782 16s 10d $\frac{1}{2}$ A.	

Or thus

Multiply the given quantity 249.84375 (according to the *Contraction* in *page* 287) by 3.133333 = £3 2s 8d (the given price) and the product *viz* the answer, will be £782.8437 the same as above. So that by proceeding according to any of these methods, the value of any quantity of goods may be easily known at any given price. And now before I conclude this *excellent rule*, it may not be amiss to observe to the learner,

learner, that if the given price be a compoſite number, greater than 12 and an aliquot part of a pound &c. it is oftentimes more conciſe to divide by its component parts, as may be ſeen in ſeveral of the preceding examples in this rule *viz.*

In the example at	*d*	the diviſors are		and		the com. parts of		the aliquot part that the giv. price	*d*
	1		8		60		480		1
	1 1/2		4		80		320		1 1/2
	2		8		12		96		2
	3		8		8		64		3
	3 1/2		4		8		32		3 1/2
	4		4		6		24		4
	4 1/2		4		4		16		4 1/2
	7								7
	10								10
	15								15

is of a pound.

EXTRACTION of the SQUARE ROOT.

COME *Tyro* haſte, your ſkill exert,
To learn this *Rule* pray be expert,
For *Evolution* points out fair
How roots of ſquares extracted are,
All this with eaſe you'll quickly know,
By th' *Table* and the *Rule* below.

TABLE.

Roots	1	2	3	4	5	6	7	8	9
Squares	1	4	9	16	25	36	49	64	81

RULE.

YOUR periods pointed fair and true
Under the firſt, beſure put you
The neareſt ſquare you find come to't
And for the quotient place the root,

Then

Then from that period next ſubtract
Th' aforeſaid ſquare to be exact
To this obſerve next period's brought
The quotient doubled—next is ſought
What times that quote contain'd will be
In the reſolvend—*Tyro* ſee
You leave your units place quite free.
Becauſe that place your ſquare ſupplies,
As th' quoted figure multiplies,
Subtracting next you thus go on,
Until your operation's done,
But if you find your number be
A ſurd—obſerve me inſtantly,
Periods of cyphers bring thereto,
For decimals work nearly true.

EXAMPLE I.

What is the Square Root of 76176?

```
      76176 (276 Root
      4
      ----
47)   361
      329
      ----
546)  3276
      3276
      ----
```

EXPLANATION.

The number being ſeparated or pointed into periods of 2 figures each, then the neareſt ſquare number to 7 the firſt period is 4 which is ſet under and ſubtracted therefrom, and 2 the ſquare root of 4 is placed in the quotient, and to the remainder 3 the next period 61 is brought down or annexed which makes 361 for a new dividend or reſolvend, to the left hand whereof is placed 4 *viz.* the quotient doubled or multiplied by 2, and as 36 (part of the reſolvend) contains 4 (part of the diviſor) with what will be carried to the product, 7 times, 7 is ſet in the quotient and to the right hand of the diviſor

diviſor alſo, making it 47 which being multiplied by 7 the product 329 is ſet under and ſubtracted from 361 the new reſolvend, and to 32 the remainder, 76 the 3d and laſt period is annexed making 3276 for another new reſolvend, to the left of which is placed 54 the double of the quotient 27, then as 54 is contained in 327 (part of the new reſolvend) 6 times therefore 6 is placed in the quotient and likewiſe to the right of the diviſor, making it 546 which being multiplied by the quotient figure 6, the product 3276 is ſet under the reſolvend, and as nothing remains the work is finiſhed and 76176 found to be a ſquare number and 276 its root. Hence it is eaſy to

OBSERVE

That every Root muſt conſiſt of as many places of figures as there are periods in the given number, and will be Integers or Decimals reſpectively as the periods are ſo, from which they are found or to which they correſpond. And alſo that doubling the unit's figure of each diviſor *viz.* adding thereto its unit's figure produces part of the ſucceeding diviſor the ſame *(and is full as expeditious)* as the before-mentioned method of doubling the quotient, for (in this example) 27 doubled makes 54 (part of the laſt diviſor) and ſo does the firſt diviſor 47 when added to 7 its unit's figure.

To prove the ſquare root is only to multiply the root by itſelf thus $276 \times 276 = 76176$ the given reſolvend in this example.

EXAM-

EXAMPLE 2.

Extract the square root of

```
      . . . .
      29506624 (5432
      25          Root
      ---
104)  450
      416
      ---
1083)  3466
       3249
       -----
10862)  21724
        21724
        -----
```

EXAMPLE 3.

Extract the square root of

```
      . . . . .
      .0001522756 (.01234
        1           Root
        ---
22)     52
        44
        ---
243)    827
        729
        ----
2464)    9856
         9856
         ----
```

EXAMPLE 4.

Extract the square root of 5467.184.

```
      . . . .
      5467.1840 (73.9404084 &c.
      49
      ---
143)  567
      429
      ----
1469)  13818
       13221
       -----
14784)  59740
        59136
        -----
1478804)  6040000
          5915216
          -------
147880808)  1247840000
            1183046464
            ----------
1478808164)   6479353600
              5915232656
              ----------
               564120944
              ----------
```

In the given number of this example there being but 3 decimals, a cipher was annexed to make 'em up an even number, in order that they might be divided into periods as before, and when any number to be extracted is (like *this*) not a square but irrational, periods of ciphers may be added at pleasure,

pleaſure, and the further you proceed, the more exact will the root be, but for common purpoſes 4 places of decimals are ſufficient.

But when the root is to be extracted to a great number of places, the work may be much abbreviated thus, proceed by the common method till you have one figure more than half the number there is to be in the root; then divide the remainder (according to the *contraction* in diviſion of decimals *page* 292) by the double root except the right hand figure, and the quotient will be the remaining part of the root, as in this example, the remainder after multiplying by the 6th figure in the root is 124784 which being divided (agreeable to the above-mentioned *contraction*) by 147880 (the correſponding diviſor or double of the root except the right hand figure) quotes 084 &c. the remaining part of the root as in the preceding *page*.

COROLLARY.

When the Square Root *of any* vulgar fraction *is required*—Take the Root of the numerator and denominator if the fraction be a complete power, thus the Square Root of $\frac{25}{81}$ is $\frac{5}{9}$, but if the fraction be not a complete power, then reduce it to a decimal and proceed as herein before taught.

The USE of the SQUARE ROOT.

To find a mean proportional *between any two given numbers.*

RULE

To find a mean proportional
Of any numbers great or ſmall
The ſquare root of their product true
Brings out an anſwer to your view.

Queſtion

Question 1.

Find a mean proportional between 36 and 64.

First 36 × 64 = 2304 *then* 2304 (48 Answer,

```
                 16
                 ---
              88) 704
                  704
                  ---
Proof
As 36 : 48 :: 48 : 64   0
                  ---
```

Question 2.

If th' area of a circle be
As in the margin * you may see
What is the side then of a square,
Equal in area, pray declare.

* 33124

The square root of 33124 = 182 the Answer.

Question 3.

To humble *France*, suppose a Gen'ral sent
With a fine army o'er the continent,
Whose number just of valiant fighting men,
Is forty thousand, four hundred and one,
How many men in rank and file must be
To form a square battalia tell to me.

The square root of 40401 = 201 the Answer.

Question 4.

A set of true Britons all jovial and free,
Were drinking full bumpers to dear LIBERTY,
Till the reck'ning came to the sum * here subjoin'd
The number of persons,–haste *Tyro* and find,
Whose share must be equal, this tell unto me,
No doubt but *Mæcenas* will smile upon thee.

* 1 p – s – 17

£	s	d	farthings	
1	–	– $\frac{1}{4}$	= 961	(31 men Anſwer
			9	
			61) 61	
			61	
			.	

men farthings man *d*
If 31 : 961 :: 1 : 7 $\frac{3}{4}$ each man's ſhare.

PROMISCUOUS QUESTIONS.

Queſtion 1. By Mr. *Rob. Wilſon, Ladies Diary* 1713.

A caſtle wall there was whoſe height was found
To be one hundred feet, from th' top to th' ground,
Againſt the wall, a ladder ſtood upright,
Of the ſame length, the caſtle was in height.
A waggiſh fellow did the ladder ſlide
(The bottom of it) ten feet from the ſide.
Now I would know how far the top did fall,
By pulling out the ladder from the wall.

100 } ſquared = { 10000
10 } { 100

Difference 9900 the ſquare root whereof *viz.* 99.498+ feet, is the height of the wall to the top of the ladder after it was pull'd out, which being deducted from 100 feet the whole height of the wall, leaves .502 *viz.* a little more than *half a foot*, the anſwer.

Queſtion

Queſtion 2. By Mr. *Maſſey*. *Ladies Diary*, 1716.

A wealthy *Knight* in *Lincolnſhire* reſides,
Whoſe fields are waſh'd by the redundant tides
Of *Witham's* cryſtal ſtream; his chiefeſt care
Pomona like is now to bleſs the year;
With fruitful products from the teeming tree,
For none more vers'd in ruſtic cult' than he.
Oblong in form, extended from his houſe,
He did a cloſure for his garden chuſe
With choſen walnut plants, he ſet it round
At once to ſhade his walks and load the ground,
Succeeding Summers, with prolific heat,
Manur'd the infant trees, and made them great.
That they expand their tow'ring heads in air,
And ſtore of barricaded kernels bear;
September laſt the *Knight* his man employ'd.
To gather all the nuts his trees ſupply'd;
The man returns and with myſterious phraſe
Premeditated to his maſter ſays.
Sir, your commands, I willingly obey'd,
And as I wrought, this obſervation made,
On ev'ry tree ſo many boughs are found,
As there are trees in all your garden round.
Nine of theſe trees as many walnuts bear,
As upon all the trees there branches are,
If that you multiply this ſum by three,
You in the product all the nuts may ſee. (2187)
What *Sir*, from this account I humbly crave
Is that you tell how many trees you have,
The *Knight* unſkill'd in ſuch conceits as thoſe,
Took up the nuts, and ſmiling off he goes;
But turning ſhort again, ſays, hark you *Nat*,
Send Mr. *Tipper's* correſpondents that.

3) 2187

Boughs 729 (27 trees Anſwer
4

47) 329
329

trees nuts trees nuts
If 9 : 729 :: 27 : 2187.

EXTRACTION of the CUBE ROOT.

A *Cube* (I ſay) to tell you true,
Contains length, breadth, and thickneſs too,
A *Cube*'s a figure you may ſee,
Derived from *Geometry*.
How to extract in ev'ry part,
And find the root——pray get by heart
The following *Table* which you view,
And *Rule* I here preſent to you.

TABLE.

Roots	1	2	3	4	5	6	7	8	9
Squares	1	4	9	16	25	36	49	64	81
Cubes	1	8	27	64	125	216	343	512	729

RULE.

" The cube of your firſt period take,
" And of its root a quotient make."
Subtract this cube and what you find
To be the diff'rence, left behind,
To that bring down th' next period true,
Your dividend appears in view.
A true diviſor next to find,
Firſt to the quote, a cypher's join'd,
Then call it *R*, and let that be,
Firſt ſquar'd, then multiply'd by *three*,

Now

Now ask how oft this number can
Within the dividend be ta'en
The quote call *S*, then by it you
Must multiply the divisor too,
This product you must write down plain
Under the dividend——again
Next multiply your *R* by *three*,
And that by th' square of *S* must be
Involv'd, put down, the root t' express,
Write under that the cube of *S*.
These sums being added up and penn'd,
Subtract them from your dividend,
To what remains th' next period's brought,
If any more, or roots are sought.

EXAMPLE I.

What is the Cube Root of 32768?

$$\begin{array}{rl} & 32768\ (32 \text{ Root.} \\ & 27 \\ \hline 30\times30\times3. = 2700) & 5768 \text{ Dividend.} \\ \hline \end{array}$$

$$\left.\begin{array}{l} R \\ S \end{array}\right\} = \left\{\begin{array}{l} 30 \\ 2 \end{array}\right. \qquad \begin{array}{l} 5400 = 30\times30\times3\times2 = R^2\times3\ (\times S \\ 360 = 30\times3\times4 = R\times3\times S^2 \\ 8 = 2\times2\times2 = S^3. \\ \hline 5768 \text{ subducend} \end{array}$$

EXPLANATION.

The nearest cube to 32 the first period is 27, which is set under and subtracted therefrom, and 3 the root of the said cube is placed in the quotient, and to the remainder 5, the period 768 is annexed which makes 5768 for a dividend, then a cipher is joined to the quotient figure 3 making it 30 which is call'd *R*, and

being ſquared and that ſquare multiplied by 3 produces 2700 for a diviſor which being contained twice in the dividend, 2 is placed in the quotient and called S by which the diviſor is multiplied and the product 5400 ſet under the dividend, then 3 times $R = 90$ is multiplied by 4, the ſquare of S, and the product 360 is placed under the 5400, and laſtly S the cube of S, is placed under, and added to the other two numbers under the dividend, and the ſum 5768 being the ſame as the dividend and no more periods to be brought down the work is finiſhed, 32768 found to be a cube number and 32 its cube root.—To prove the cube root is only thrice involving the root into itſelf *viz.* multiplying the root by itſelf and that product or ſquare by the ſame root again, thus, the cube of 32 is $32 \times 32 \times 32 = 32768$ the given reſolvend in this example.

EXAMPLE 2.

What is the cube root of 242970624?

242970624 (624 root.
216

$R^2 \times 3 = 10800$) 26970 dividend

$R = 60$, $S = 2$

$21600 = R^2 \times 3 \times S$
$720 = R \times 3 \times S^2$
$8 = S^3$

22328 ſubducend

$R^2 \times 3 = 1153200$) 4642624 = 2d. dividend

Here $R = 620$ and $S = 4$

$4612800 = R^2 \times 3 \times S$
$29760 = R \times 3 \times S^2$
$64 = S^3$

4642624 ſubducend

EXAMPLE 3.

The side of a cubical vessel define,
T' contain less nor more than four gallons of wine.

A gallon of wine being 231 solid Inches (see *page* 20) then four gallons must be 4 times as many *viz* 924 (9. 739 Root or side of the vessel.

```
                 729
                ------
24300)          195000
                ------
                170100
                 13230
                   343
                ------
R} = {90
S} = {7
                183673
                ------
2822700)        11327000
                ------
Here R} = {970
and S} = {3
                 8468100
                   26190
                      27
                ------
                 8494317
                ------
284018700)      2832683000
                ------
Here R} = {9730
and S} = {9
                2556168300
                   2364390
                       729
                ------
                2558533419
                ------
                 274149581
```

In this example you may observe that tho' the *first divisor* is contained 8 times and the *second*, 4 times, in their respective dividends, yet only 7 and 3 are placed in the quotient or root because subducends produced from 8 and 4 would be too much *viz.* greater than the dividends.—*To extract the Cube Root of a vulgar fraction* observe the directions given for extracting the Sqr. Root thereof, in *page* 312 only use the Cube Root instead of the Squr. Root.

SCHOLIUM.

The foregoing method of extracting the cube root being very practical and easy to be understood, I shall now shew how to perform the same by easy divisions and an extraction of the square root.——Suppose any number at pleasure which you think will come pretty near the root, but less; divide the resolvend by 3 times the supposed number, from the quotient deduct $\frac{1}{12}$ of the square of the supposed root, and to the square root of this remainder add half the supposed root, and the sum will be the true root.

EXAMPLE 1.

What is the cube root of 32768?—See this example *page* 317.

Suppose the root to be 30 which multiplied by 3 produces 90 whereby dividing 32768 quotes 364.08 &c.

From which deduct $\frac{1}{12}$ of 900 (the sqr. of the supposed root) *viz.* 75

and the *remainder* is 289,08 &c.

289 (17
1 15 = half the
—— —— suppo. root.
27) 189 32 Answer the
189 —— same as in
—— *page* 317.

EXAMPLE 2.

What is the cube root of 242970624?—See this example *page* 318.

Suppose the root to be 600 which multiplied by 3 produces 1800 by which dividing 242970624 quotes 134983.68

From which deduct $\frac{1}{12}$ of 600 × 600 *viz.* 30000

Remainder 104983.68

$\sqrt{104983} = 324$
$\frac{1}{2}) 600 = 300$

Answ. 624
the same as in *page* —— 318.

The

The extraction of Roots of higher powers being of little or no uſe in practical arithmetic I ſhall therefore give no general rule for their extraction but only juſt obſerve to the learner that moſt of them may be wrought by obſerving what Integer numbers multiply'd together will produce the index of the required Root and making ſuch extractions as are denominated by thoſe numbers thus, 2 the index of the Square Root multiplied by 2 produces 4 the index of the biquadrate Root therefore for that Root extract twice the Square Root, for the ſixth Root

Extr. } the { Sqr. } Root and then the { Cube } Root of that.
Or } { Cube } { Sqr. }

becauſe the Indices of thoſe Roots *viz* 2 and 3 multiplied together make 6 the Index of the required Root, ſo for the eighth Root extract thrice the ſquare Root, the cube or third power of 2 (the Index of the ſquare Root) being 8, and for the ninth Root extract twice the cube Root becauſe 3 its Index raiſed to the ſecond power *viz.* multiplied by 3 produces 9 the Index of the Root required, and ſo on as far as you pleaſe.

I ſhall now give a few queſtions to ſhew the uſe of the *Cube Root* in ſome few particulars and then proceed to treat of *Simple* and *Compound Intereſt.*

The

The Use of the CUBE ROOT.

Question 1.

Find two mean proportionals between two extremes 5 and 135

5) 135 (27. whose cube Root is 3

5 the less extreme.

Proof

As 5 : 15 :: 45 : 135

15 less mean.

3

45 greater mean.

Here the greater extreme is divided by the less, and the cube Root of that quotient multiplied by the less extreme, gives the less mean which multiplied by the said cube Root gives the greater mean, as above.

Question 2.

Sawney a youth, with an accomplish'd air,
Long courted *Moggy*, delicate and fair,
To gain her friendship ev'ry art essays,
To meet her kindness tries a thousand ways,
A glob'lar silver snuff-box *Sawney* buys,
And gives his *Moggy* with unfeigned sighs,
Which cost a guinea as it does appear,
Three inches just was the diameter,
Now *Sawney* thinks the box was rather small,
So on the silver smith again does call
To change the box—an inch and quarter more
Was the diameter than that before.
Now *Tyro* tell me what the snuff box cost,
And then of your expertness you may boast.

First

First 3 } the diam. of the { 1st } Box cu- / 27
And 4.25 } the diam. of the { 2d } bed is \ 76.7656 } Inc.

Then as all like ſolids are in triple proportion to their homologous ſides, diameters, lines &c. the proportion is.

CD	s	£	CD
As 27	: 21	= 1.05	:: 76.7656

1.05

3838280
7676560

27 { 3) 80.60388
9) 26.86796

	£	s	d
Anſwer £ 2.98532 =	2	19	8 ½

Queſtion 3.

A Farmer lent his neighbour *Gay*,
To ſerve him in his need;
Juſt ſixteen feet of good old hay,
In length, breadth, depth indeed.
The neighbour brings him twice we find,
Eight feet * it was no more,
What was the diff'rence left behind,
Come *Tyro* now explore?

16 × 16 × 16 = 4096
8 × 8 × 8 × 2 = 1024
Anſwer 3072

} ſolid feet { borrow'd repaid / unpaid

PROMIS-

* In length breadth and depth each time.

PROMISCUOUS QUESTIONS.

Queſtion 1. By Mr. *Hill.*

If a Ship of 100 tuns be 44 feet long at the keel, of what length ſhall the keel of that Ship be, whoſe burthen is 220 tuns?

Firſt $44 \times 44 \times 44 \times 220 = 18740480$ which being divided by 100 quotes 187404.8 the cube root whereof is 57.22592 feet the anſwer.

Queſtion 2. By Mr. *J. Fiſh* of *Crowl, Martin's Miſc.* What dimenſions muſt I give to a joiner, to make a cubical Box that will hold 2000 Oranges of 2 $\frac{1}{2}$ Inches diameter each, ſuppoſing the Oranges Globular, keeping that form, and laid in rows exactly at the top of each other.

Solution.

Firſt $2.5 \times 2.5 \times 2.5 = 15.625$ the ſolidity of one cube which being multiplied by the number of oranges produces 31250 the ſolidity of the 2000 cubes, or that of the box.

Then $\sqrt[3]{31250} = 31.5$ *fere* inches the ſide of the box.

SIMPLE INTEREST.

TYRO advance! with ſkill prepare,
To calculate your Int'reſt fair;
And find the gain, *per cent*, *per annum*,
Of ſums lent out by *Aunt* or *Grannum*.
By *Simple Int'reſt* you will find,
Much knowledge to enlarge the mind.
The *Principal* and *Int'reſt* count,
The ſum of both makes the *Amount*.

By

By *Simple Int'reſt* we ſhall ſhew
How to make calculations true,
In *Fact'rage*, *Brokage*, and *Inſurance* too,
And *purchaſing Stocks*, as you will find,
In th' pages hereunto ſubjoin'd.

RULE.

To find the Int'reſt for a year,
To multiply you muſt prepare
The principal by th' rate that's given,
The ſum *per Cent.* be't odd or even;
Then laſtly by *one hundred* you
Before divide th' product true,
The anſwer will appear in view.
If Int'reſt for more years than one
Shou'd be requir'd 'tis quickly done,
The firſt year's Int'reſt multiply
By th' whole * the anſwer you'll deſcry,
For part or parts, the ſum t'obtain,
Take parts thereof, of one year's gain;
And if for months, the Int'reſt you
Require:—obſerve this maxim true,
In al'quot parts; the months divide,
The anſwer may be ſoon eſpy'd.
And if for weeks, be more or leſs,
Which al'quot parts, will not expreſs;
The number multipli'd muſt be
By th' Intereſt of a year—you'll ſee
If you divide by *fifty two*,
The quotient will your anſwer ſhew.
For days,—obſerve to multiply
By one year's Int'reſt you'll deſcry
An anſwer—when you laſt divide
By th' days, that's in one year beſide.

* Number of years.

Example 1.

What is the Intereſt of 300 Guineas for a year, at £5 *per Cent?*

£ £ £
As 100 : 5 :: 315 = 300 Guineas

5

£ 15 | 75
20
s | —
15 | 0

Note. The dividing by 100 in this and the following examples (where needful) is performed by cutting off the figures with a ſtraight line. See the reaſon *page* 291.

2d. By *Practice.*

£ £
5 = $\frac{1}{20}$) 315

Anſwer £15 15s

3d. By *Decimals*

£
315 principal
.05 ratio

Anſw. 15.75 = £15 15s

The above example is worked by 3 different methods, to ſhew the conciſeneſs of each.—The ratio or rate of £1 for a year at the given rate is thus found. As £100 : £5 :: £1 : £.05 and ſo may any other ratio be found as in the annexed table.

Table

Rate		*Ratio*
3		.03
3 $\frac{1}{2}$		.035
3 $\frac{3}{4}$		.0375
4	=	.04
4 $\frac{1}{4}$		.0425
4 $\frac{1}{2}$		.045
5		.05

Note. Lawful Intereſt is £5 *per cent. per annum,* that is £5 for the uſe or Intereſt of £100 for a year or 12 months.

Example

Example 2.

At Simple Intereſt tell me plain,
What fourteen thouſand pound will gain;
At three pound ten *per cent. per annum*,
For ſeven years to pleaſe a *Grannum*.

	£		By *Decimals*.
$\frac{1}{2}$)	14000		£
	$3\frac{1}{2}$		14000 principal
			.035 ratio
	42000		
	7000		70000
			42000
	490 Int. for 1 yr		
	7 No. of yrs.		490 Int. for 1 yr.
			7 No. of yrs.
Anſw.	3430		£3430 Anſwer

Example 3.

What is the Intereſt of £206 12*s* for $4\frac{1}{4}$ years, at £$5\frac{1}{2}$ *per cent. per annum*?

£	£	*s*				£	*s*
5 | $\frac{1}{20}$ |	206	12					
s							
10 | $\frac{1}{10}$ |	10	6	7	Int. for a year at		5	–
	1	–	$7\frac{3}{4}$			–	10
	11	7	$2\frac{3}{4}$			5	10
			$4\frac{1}{4}$ No. of years				
	45	8	11	Int. for		4 years	
	2	16	$9\frac{1}{2}$			$\frac{1}{4}$	
Anſwer	£48	5	$8\frac{1}{2}$			$4\frac{1}{4}$ years.	

per Cent.

Example 4.

What will £342 amount to in 10 months at £5 *per Cent. per Annum.*

£		£		
5	$\frac{1}{20}$	342		
6 *mo.*	$\frac{1}{2}$	17	2*s*	In. for 1 yr.
4 *mo.*	$\frac{1}{3}$			
To		8	11	Int. for 6 months
Add		5	14	4
Th. to		14	5	10
Add		342	–	the princi.
		£356	5	Answ.

Example 5.

What is the amount of £400 for 13 weeks, at £4 $\frac{3}{4}$ *per Cent. per Annum?*

	£			
	400			
	4 $\frac{3}{4}$			
	1600			
	300			
$\frac{1}{4}$)	19			Int. for 1 yr.
To	4	15		13 w
Add	400	–		the princip.
An.	£404	15		amount

Example 6.

What is the Interest of £68 5*s* 8*d* for 3 years and 7 months, at £4 5*s* *per Cent. per Annum?*

	£	*s*	*d*		
$\frac{1}{4}$)	68	5	8		£ *s*
			4 $\frac{1}{4}$	=	4 5
	273	2	8		
	17	1	5		
* £2	90	4	1		
	20				
s 18	04				
	12				
d –	49				
	4				
$\frac{1}{4}$	96				

	£	*s*	*d*		
*	2	18	– $\frac{1}{4}$	Int. for 1 yr.	
			3		
6 *mo.* $\frac{1}{6}$	8	14	– $\frac{3}{4}$	Interest for	3 years
1 *mo.* $\frac{1}{6}$	1	9	–		6 months
		4	10		1 month
Ans.	£10	7	10 $\frac{3}{4}$		3 yrs. 7 m.

Exam-

EXAMPLE 7.

What will £700 15*s* amount to in 30 weeks at £4½ *per Cent. per Annum?*

£	£ s
700.75	= 700 15
.045	Ratio
350375	
280300	
31.53375	Interest for 1 year
30	
52) 946.0125	(18.1925 = 18 3 10
	Principal 700 15 –
	Answer £718 18 10

EXAMPLE 8.

From *January* th' tenth, in a *Biſſextile* Year,
To *December* the eighteenth, I pray make appear.
What th' amount of ſix hundred bright Guineas will be
At four and a half *per Cent.* * tell unto me?

£	*Guin.*	
630	= 600	Principal
.045		Ratio
3150		
2520		
28.35		Int. for 1 year
343		Days
8505		
11340		
8505		

£	£ s d	
365) 9724.05	(26.6412 = 26 12 9¾	Int.
	630 — —	Prin.
	Answer £ 656 12 9¾	Amount

Note. This queſtion or any other of the kind may be eaſily anſwered by the help of the decimal table in the following *page*.

* *Per Annum.*

Or by the help of the annext table, thus

The tabular number— .00012328767 multiplied by £ 630 the principal, and that product by 343 the number of days, produces £26.6412 &c. = 26 £ 12 *s* 9 *d* ¾ the intereſt the ſame as in *page* 329.

TABLE.

Rate *per Cent.*		Int. of £ 1 for a Day
£		£
3	=	.00008219178
3½	=	.00009589041
4	=	.00010958904
4½	=	.00012328767
5	=	.0001369863
5½	=	.00015068493
6	=	.00016438356

EXAMPLE 9. *For the Ladies.*

Old *Jerry*, had a daughter gay,
Whoſe wit and charms might vie,
With *Flora*, goddeſs of the May,
Or blooming *Margery*.
Young *Hodge*, a jocund country ſwain,
When tripping thro' the grove,
Oft ſigh'd, and wiſh'd this maid to gain,
His thoughts were built on love.
At length he gain'd the maid's conſent,
To viſit *Hymen*'s ſhrine,
And to the Church they ſtraightway went,
Where love and friendſhip join.
Old *Jerry*, (like a father) kind,
Gave to them as appears,
A ſum, at int'reſt as we find,
Had been for ſeven years
And threeſcore days as writings ſhew,
The ſum five hundred pound;
When firſt put out, believe it true,
(Here kindneſs did abound.)
At ſimple int'reſt *Ladies* find,
Th' amount of this their ſtore,
Which pleas'd the happy pair ſo kind,
At five *per Cent.* * explore,

* *per Annum.*

RULE

	£	s	d		
First 500 × .05 = £25 the Int. for 1 year which being multiplied by 7 the number of years, produces	175	—	—	the Interest for	7 years
Dys £ Dys As 365 : 25 .: 60 60					
365) 1500 (4.1095 &c. =	4	2	$2\frac{1}{4}$		60 days
Then to	179	2	$2\frac{1}{4}$		7 ys & 60 dys
Add	500	—	—		Principal
Answ.	679	2	$2\frac{1}{4}$		Amount

Or, the Interest for the 60 days may be found by the help of the *Table* in *page* 330 thus .0001369863 the tabular number at £ 5 *per Cent*. multiplied by 60 and that product by £500 the principal, produces £4.1095 &c. = £4 2*s* 2*d* $\frac{1}{4}$ the Interest for the 60 days, the same as above.

COROLLARIES.

Cor. 1. *When the* interest, rate, *and* time, *are given to find the* principal.—Divide the interest, by the product of the ratio and time, the quote is the principal.

Cor. 2. *When the* amount, rate, *and* time, *are given to find the* principal.— To the product of the raito and time add *unity*, by which sum divide the amount, the quote is the principal.

Cor. 3. *When the* principal, interest, *and* rate, *are given to find the* time.—Divide the interest by the product of the principal and ratio, the quote is the time.

Cor.

Cor. 4. *When the* principal, intereſt, *and* time, *are given to find the* rate, *per Cent.*—Divide the intereſt by the product of the principal and time, the quote is the ratio.

Example 10.

What principal put out to intereſt for $4\frac{1}{2}$ years will gain £58 14*s* 6*d* at £4 *per Cent. per Annum?*

By Cor. 1. *Page* 331.

Time 4.5
Ratio .04
Prod. .18

.18 { .2) 58.725 = £58 14*s* 6*d* the Intereſt
.9) 293.625

Anſw. £326.25 = £326 5*s*

Example 11.

To pay a debt of forty pound,
Which three years hence is due,
What preſent money pray expound,
At *five per Cent.* will do?

By *Cor.* 2. In the preceding *page.*

.05
3

Product of rate and time *plus* unity 1.15) 40.0 (34.7826 = £34 15*s* 7¾*d* Anſw.

Example 12.

In what time will £500 gain £120 at £6 *per Cent. per Annum?*

By *Cor.* 3. In the preceding *page.*

Principal 500
Ratio .06
Product 30.

30) 120 Intereſt

Anſwer 4 years

Exam-

EXAMPLE 13.

In what time will two hundred *Moidores* raise,
(At simple int'rest,) tell me if you please,
A stock of just four hundred *Ports* define,
At three *per Cent.* in royal *British* coin.

		£	s		£		
First 400 Ports and 200 Moids.	at	1	16	a piece =	720	the	St. or Am.
		1	7		270		Principal
				Remains	450		Interest

Then by *Cor.* 3. *Page* 331.

	£		£	
Principal	270		9) 450	Interest
Ratio	.03	8.1	.9) 50	
Product	8.1		Answ. 55.55 &c. = $55\frac{5}{9}$ yrs.	

EXAMPLE 14.

At what rate *per Cent.* will £216 10*s* gain £43 6*s* in 4 years.

By *Cor.* 4. In the preceding *page*.

	£		£	£	
Principal	216.5				
Time	4				
Product	866.)	43.30	(.05	Ratio	
		43 30			
				Answ.	5.

EXAM-

EXAMPLE 15.

At what rate *per Cent.* will £643 2*s* 6*d* amount to £787 16*s* 6*d* ¾ in 5 years.

	£	£	*s*	*d*	
1*ſt.* From	787.828125	787	16	6¾	Am.
Deduct	643.125	643	12	6	Pr.
Remains	144.703125	144	14	−¾	Int.

Then by *Cor.* 4 *Page* 332.

	£			
Principal	643.125			
Time	5			
Product	3215.625	£ 144.703125	Ratio .045	Anſw. £4 10*s*

SCHOLIUM.

Having given variety of examples to ſhew the ingenious learner how to proceed with Simple Intereſt, I ſhall now add a few examples concerning *Factorage*, or *Commiſſion*, *Brokage*, *Inſurance*, and purchaſing *Stocks*, and then proceed to *Compound Intereſt*, or *Intereſt* upon *Intereſt*.

Factorage, *Proviſion*, or *Commiſſion*, is an allowance that is generally made to agents, or factors beyond Sea, for buying or ſelling of goods, at a given or certain rate *per Cent.* according to the cuſtom of the country the factor, or merchant reſides in.

Brokage, is an allowance made to brokers, or any perſon who is employed to aſſiſt others in buying, or diſpoſing of their goods, and in *London* are not to act without the *Lord-Mayor*'s licence.

Inſurance,

Inſurance, is ſecurity given by perſons who oblige themſelves to anſwer for the loſs or damage of ſhips, houſes, goods &c. by ſtorms, pirates, fire, &c. in conſideration of a premium paid down to reſtore whatſoever value the premium is advanced for by the proprietors of the thing injured.

Stocks are the public funds of the nation, the ſhares whereof are transferable from one perſon to another, and occaſion that extenſive buſineſs called *Stock-jobbing*, or (as Mr. *Hutton* in his Schoolmaſters Guide, juſtly remarks) the worſt kind of Gaming.

Example 16.

What is the commiſſion of £649 10*s* at £3 ¼ *per Cent?*

	£	*s*	
¼)	649	10	
		3 ¼	
	1948	10	
	162	7	6
£21	10	17	6
	20		
2*s*	17		
	12		
2*d*	10		
Anſwer	£21	2*s*	2*d*

Or thus

649.5
.032 5

32475
12990
19485

Anſ. 21.10875 = £ 21 *s* 2 *d* 2 the ſame as before.)

Exam-

Example 17.

What is the brokage tell me true
Of what you in the margin view, * £1000 10*s* 6*d*
Allowing sev'nty pence, † not more, † *per Cent.*
Ingenious *Tyro* this con o'er.

£		s	d			£	s	d		£	s	d	
10	00	10	6 ½	5*s*	¼	10	–	1 ¼	the brokage at	1	–	–	*per Cent.*
		12		*d*									
	d	—		10	⅙	2	10	– ¼		–	5	–	
	1	26					8	4		–	–	10	
		4											
		—		An. £		2	18	4 ¼		–	5	10	
	¼	06											

Example 18.

Suppose I make an Insurance of goods &c. to the value of £4960 at 4*s* 6*d* *per Cent per Annum*, what doth the Insurance come to?

£		s		£	s	d		£	s	d	
49	60	4	⅕	49	12	–	the Insur. at	1	–	–	*per Cent.*
	20	*d*									
s	—	6	⅛	9	18	4 ¾		–	4	–	
12	00			1	4	9 ½		–	–	6	
		An. £		11	3	2 ¼		–	4	6	

Example 19.

Admit an *East-India* Ship be valued at £12768 15*s* what is the Insurance, supposing it to be at £15 ⅜ *per Cent?*

First £12768 15*s* = £12768.75, and £15 ⅜ = £15.375

Then £12768.75 multiplied (according to the *contraction* in *page* 287) by 15.375 produces £196319.5 which being divided by 100 *viz.* the decimal point removed 2 figures farther to the left hand (see *page* 291 quotes £1963.195 = £1963 3*s* 10*d* ¾ the Answer.

EXAMPLE 20.

What is the purchaſe of £460 *South Sea Stock*, at £116 4*s per Cent?*

s	£		£	*s*	*d*		£	*s*	
4 = 1/5	460	To	460	–	–	the purchaſe at	100		per Cent.
	16	Add *	74	10	4 3/4		16	4	
	7360	Anſw.	534	10	4 3/4		116	4	
	92								

£ *	74	52
s		20
10	4	
d		12
4		8
		4
3/4		2

EXAMPLE 21.

What is the purchaſe of £ *s*
12768 15 *Bank Annuities* at £84 5/8 *per Cent?*

The given rate wanting but £15 3/8 of being at *Par* or *Cent. per Cent.* therefore

			£	*s*	*d*		£		
From Dedt. exam. 19 *p.* 336	the	giv. ſum	12768	15	–		100		
		Anſ. to	1963	3	10 3/4	the purch. at	15 3/8		per Cent.
		Rems. £	10805	11	1 1/4		84 5/8		

PROMISCUOUS QUESTIONS.

Queſtion 1. by Mr. *Clare.*

Lent 109 Guineas at £4 *per Cent.* which by the 18th of *Auguſt* 1760, was raiſed by the intereſt to ſo many Moidores bating 2*s* 6*d* pray on what day did the bond bear date?

	£	*s*	£	
Firſt 109 Guineas =	114	9	= 114.45	the Principal
and 109 Moidores =	147	3		from which abate 2*s* 6*d*

and the Amount is £147 –*s* 6*d* from which deduct the Principal, and the remainder will be £32 11*s* 6*d* = £32 575 the Intereſt.

Then by *Cor.* 3. *page* 331.

114.45
.04

Years

4.578)32.575(7.11555 = 7 years and 42 days, the time the 109 guineas were out at intereſt, and which time the queſtion ſays expired on the 18th *Auguſt*, 1760.—Now to 31 the number of days in the preceding month *July*, add the 18 days in *Auguſt*, and the ſum will be 7 days more than 42, whereby it is plain that the bond was dated 7th *July* 1753, for from that time to 7th *July* 1760 are 7 years, and from 7th *July* 1760 to 18th *Auguſt* following are 42 days, which together make 7 years and 42 days, as above.

Queſtion 2. by Mr. *James Hardy*.

See (that excellent treatiſe) his Elements, or Theory of Arithmetic, *page* 303.

A man lent his friend £750 for one year; in the mean time being in want of caſh, he diſpoſed of ſome South-Sea Stock; upon going to replace it, found the market had roſe, ſo that he was a loſer of £27 14*s* 8*d* ¼ which he reſolved his friend ſhould make good for the uſe of the money lent to him: It is required to find how much he was charged *per Cent. per Annum?*

	l	*s*	*d*		*l*
Firſt	27	14	8 ¼	(the Intereſt) =	27.734375

Then by *Cor.* 4. *page* 332.

	l	*s*	*d*
750)27.734375(.03697916 Ratio =	3	13	11 ½

the Rate required.

COM-

COMPOUND INTEREST.

THIS rule compounded does appear,
Becauſe the Int'reſt ev'ry year
Is not receiv'd—but added to
The principal, 'till more is due.
This Int'reſt upon Int'reſt we
May truly call—but as you ſee
It is not lawful ſo to be.

RULE.

The firſt year's Int'reſt you muſt find,
In which the principal is join'd
Or added to, the ſum will be,
A ſecond principal you'll ſee;
And thus you muſt advance on ſtill
For any years, be what they will,
The given principal ſubtract,
From th' laſt amount to be exact;
And the remainder you will find,
Will give the Int'reſt to your mind.

Example 1.

What is the Compound Intereſt of £268 forborn 3 years at £5 *per Cent. per Annum?*

£
268
1.05
1340
2680
281.4 firſt
1.05
14070
28140
295.47 ſecd.
1.05
147735
29547 0
310.2435 third
268. principal
42.2435 = £ s d 42 4 10¼ (Anſwer

year's amount

Or thus

£ £
5 = 1/20) 268 } 1ſt yrs { prin.
13.4 } { Intereſt

1/20) 281.4 } 2d yrs { prin.
14.07 } { Int.

1/20) 295.47 } 3d yrs { pr.
14.7735 } { Int

From 310.2435 } amt.
Dedt 268. } the { 1ſt pr
Rem. £42.2435 } Intr.

Example 2.

What is the Compound Intereſt of £794 12s 6d forborn 4 years at £4 *per Cent. per Annum?*

Firſt £794 12s 6d = £794.625. *Then* 794.625 × 1.04 × 1.04 × 1.04 × 1.04 = 929.598 &c. = £929 11s 11d ½ the amount, from which deduct £794 12s 6d the principal, and there will remain £134 19s 5d ½ the Intereſt.

Example

EXAMPLE 3.

What is the compound Intereſt of £217 for a year, at £5 *per Cent. per Annum*, ſuppoſing the Intereſt payable quarterly?

$\frac{1}{4}$)
217 × .05 = 10.85 } the { In. for 1 year
To 2.7125 } the { In. for 1ſt qur.
Add 217. } the { 1ſt. princip.
219.7125 prin. for 2d. quar.
.05
$\frac{1}{4}$) 10.985625

To 2.7464 } the { Int. for 2d,
Add 219.7125 } the { prin. for 2d,
222.4589 principal { for the 3d, } quarter.
.05
$\frac{1}{4}$) 11.122945

To 2.7807 } the { Int. for 3d,
Add 222.4589 } the { prin. for 3d,
225.2396 { prin. for the 4th, } quarter.
.05
$\frac{1}{4}$) 11.26198

To 2.8154 } the { Int. prin. } for the 4th qur.
Add 225.2396 }
From 228.055 } the { amount
Dedt. 217. } the { 1ſt, principal
Rem. 11.055 = £11 1s 1d the Anſwer

The foregoing methods of working Compound Intereſt (tho' generally taught in ſchools) being rather tedious, I ſhall therefore ſhew the learner a much ſhorter method by the help of the two following tables,

TABLE I.

Years	The Amount of £1 at Comp. Int. for years.			
	3½ *p. Cent.*	4 *p. Cent.*	4½ *p. Cent.*	5 *p. Cent.*
1	1.035	1.04	1.045	1.05
2	1.071225	1.0816	1.092025	1:1025
3	1.1087178	1.124864	1.1411661	1.157625
4	1.147523	1.1698586	1.1925186	1.2155063
5	1.1876863	1.2166529	1.2461816	1.2762816
6	1.2292553	1.265319	1.3022601	1.3400956
7	1.2722792	1.3159318	1.3608618	1.4071004
8	1.316809	1.3685691	1.4221006	1.4774554
9	1.3628973	1.4233118	1.4860251	1.5513282
10	1.4105987	1.4802443	1.5529694	1.6288946
11	1.4599697	1.5394541	1.622853	1.7103393
12	1.5110686	1.6010322	1.6958814	1.7958563
13	1.563956	1.6650735	1.7721961	1.8856491
14	1.6186945	1.7316764	1.8519449	1.9799316
15	1.6753488	1.8009435	1.9352824	2.0789282
16	1.733986	1.8729812	2.0223701	2.1828746
17	1.7946755	1.9479005	2.1133768	2.2920183
18	1.8574892	2.0258165	2.2084787	2.4066192
19	1.9225013	2.1068492	2.3078603	2.5269502
20	1.9897888	2.1911231	2.411714	2.6532977
21	2.0594314	2.2787681	2.5202411	2.7859626
22	2.1315115	2.3699188	2.633652	2.9252607
23	2.2061144	2.4647155	2.7521663	3.0715238
24	2.2833284	2.5633042	2.8760138	3.2251
25	2.3632449	2.6658363	3.0054344	3.3863549
26	2.4459585	2.7724697	3.1406709	3.5556727
27	2.5315671	2.8833685	3.2820095	3.7334563
28	2.6201719	2.9987033	3.4296999	3.9201291
29	2.7118779	3.1186514	3.5840364	4.1161356
30	2.8067937	3.2433975	3.7453181	4.3219424
31	2.9050315	3.3731334	3.9138575	4.5380396
32	3.0067077	3.5080588	4.0899811	4.7649416
33	3.1119425	3.6483812	4.2740303	5.0031887
34	3.2208605	3.7943165	4.46636.7	5.2533482

TABLE 2.

Days	The Amount of £1 at Comp. Int. for Days.			
	3½ *p. Cent.*	4 *p. Cent.*	4½ *p. Cent.*	5 *p. Cent.*
1	1.0000942	1.0001074	1.0001206	1.0001336
2	1.0001885	1.0002149	1.0002412	1.0002973
3	1.0002827	1.0003224	1.0003618	1.0004011
4	1.000377	1.0004299	1.0004824	1.0005348
5	1.0004713	1.0005374	1.0000031	1.0006685
6	1.0005656	1.0006449	1.0007238	1.0008023
7	1.00066	1.0007524	1.0008445	1.0009361
8	1.0007542	1.00086	1.0009652	1.0010699
9	1.0008486	1.0009075	1.0010859	1.0012037
10	1.0009429	1.0010751	1.0012066	1.0013376
20	1.0018867	1.0021512	1.0024148	1.002677
30	1.0028315	1.0032288	1.0036243	1.0040182
40	1.0037771	1.0043074	1.0048354	1.0053611
50	1.0047236	1.0053871	1.0060479	1.0067059
60	1.005671	1.006468	1.0072618	1.0080525
70	1.0066193	1.0075501	1.0084773	1.0094009
80	1.0075685	1.0086333	1.0096942	1.0107511
90	1.0085186	1.0097177	1.0109125	1.0121031
100	1.0094696	1.0108033	1.0121324	1.0134569
110	1.0104214	1.01189	1.0133537	1.0148125
120	1.0113742	1.0129779	1.0145765	1.0161699
130	1.0123279	1.0140670	1.0158007	1.0175291
140	1.0132825	1.0151572	1.0170265	1.0188902
150	1.0142379	1.0162487	1.0182537	1.0202531
160	1.0151943	1.0173412	1.0194824	1.0216178
170	1.0161516	1.018435	1.0207126	1.0229843
180	1.0171098	1.0195299	1.0219442	1.0243527
190	1.0180689	1.0206261	1.0231774	1.0257128
200	1.0190288	1.0217233	1.024412	1.0270949
210	1.0199897	1.0228218	1.0256481	1.0284687
220	1.0209315	1.0239215	1.0268858	1.0298444
230	1.0219142	1.0250223	1.0281249	1.0312219
240	1.0228778	1.0261243	1.0293655	1.0326013
250	1.0238424	1.0272275	1.0306076	1.0339825

The conſtruction of *Table* 1ſt. is no more than involving the amount of £1 for a year, to the power of the number of years. Thus for 3 years 1.05 × 1.05 × 1.05 = 1.157625 as you'll find in the table under £5 *per Cent.*

Table 2d. is conſtructed by a continual multiplication of the amount of £1 for a day, (being the root of its amount for a year extracted to the 365th, power.)

The amount of £1 for a day at £5 *per Cent.* being 1.0001336 then 1.0001336 × 1.0001336 × 10001336 = 1.0004011 the amount of £1 at the ſame rate Compound Intereſt for 3 days.

COROLLARIES.

Cor. 1. *When the* principal, time *and* rate *are given to find the* amount.——Multiply the amount of £1 found in the table, at the given rate and time, by the principal, and the product will be the anſwer.

Cor. 2. *When the* rate, time *and* amount *are given to find the* principal.—Divide the given amount, by the amount of £1 in the table at the given rate and time, and the quote will be the anſwer.

Cor. 3. *When the* amount, rate, *and* principal *are given to find the* time.—Divide the amount by the principal, the quote will be the amount of £1 at the given rate, which being found in one of the tables under that rate, will ſhew the time required.

Cor. 4. *When the* amount, time, *and* principal *are given to find the* rate.—Divide the amount by the principal, and the quote will be the amount of £1, which being found in the table even with the given time, will ſhew the rate required.

EXAM-

EXAMPLE 4.

At three pound ten, * come tell to me,
What th' 'mount of ſixty pounds will be,
For twenty years, not more nor leſs,
Ingenious *Tyro* this expreſs.

By *Cor.* 1 in the preceding *page*.

1.9897888 Tabular number againſt 20 years
60 at 3½ *per Cent.*

	£	s	d
Anſ. 119.387328	= 119	7	8¾ the amt. required.

EXAMPLE 5.

To what will £463 amount to, at *L4 per Cent. per Annum*, for 220 days, Compound Intereſt?

1.0239215 = Tab. number againſt 220 days
460 at 4 *per Cent.*

6143529 00
4095686 0

	£	s	d
Amt. 471.00389	= 471	-	-¾

SCHOLIUM.

If you want to know the amount for a greater number of years or days than thoſe in the tables.—Divide the given time into ſuch parts as are in the tables, and the amounts anſwering thereto multiplied one into another continually, will produce the amount of £ 1 for the given time, with which proceed as directed in *Cor.* 1 in the preceding *page*.

* *Per Cent.-per Annum.*

EXAM-

Example 6.

What is the amount of £50 10*s* for 64 years at £5 *per Cent. per Annum*, Compound Intereſt?

First 4.3219424 and 5.2533482 } the am. of £1 for { 30 34 } years at £5 *per C.* as *per* table

Then per Scholium 4.3219424 multiplied (according to the *contraction* in *page* 287) by 5.2533482 produces 22.704669 the amount of £1 for 64 years at £5 *per Cent.* which amount being multiplied by the given principal *viz.* £50.5 will produce 1146.5857845 = £1146 11*s* 8*d* ½ the Anſwer.

Example 7.

What will £140 amount to in 167 days at £3 10*s* *per Cent. per Annum*, Compound Intereſt?

First 1.0151943 and 1.00066 } the am. of £1 for { 160 7 } Days at £3 ½ *per Cent.* (as *per* table.

Then 1.0151943 multiplied by 1.00066 produces 1.0158643 &c. the amount of £1 for 167 days at £3 ½ *per Cent.* which amount being multiplied by the principal £140, will produce 142.221002 = £142 4*s* 5*d* the Anſwer.

Example 8.

What is the preſent worth of £100 10*s* 10*d* ½ due 12 years hence, at £4 ½ *per Cent. per Annum*, Compound Intereſt?

By *Cor.* 2, *page* 344.—Divide the given amount £100.54375 (according to the *contraction* in *page* 292) by 1.6958814 *viz.* the amount of £1 for 12 years, at £4 ½ *per Cent.* as *per* table, and the quotient will be 59.287017 = £59 5*s* 8*d* ¾ the Anſwer.

Exam-

EXAMPLE 9.

A grave old Batchelor of late,
Had left him as appears,
A Legacy * by honeſt *Kate*, * of £800
T' receive in ſeven years, † † and 89 days
And being aged as we find
Juſt three ſcore years and one,
To ſell the ſum, he was inclin'd
Unto his neighbour *John*;
What was the preſent worth I ſay,
Of this ſaid Legacy?
That *John* muſt to the old man pay ‡
Come tell me inſtantly.

Firſt - 1.4071004 } amt. of £1 for { 7 years, 80 days } at £5 *per Cent.* as
and { 1.0107511, 1.0012037 } (*per* table.

Then per Scholium page 345, 1.4071004 multiplied (according to the *contraction* in *page* 287) by 1.0107511 produces 1.4222283 (the amount of £1 for 7 years and 80 days at £5 *per Cent.*) which being multiplied (according to the ſaid *contraction*) by 1.0012037 produces 1.4239402 (the amount of £1 for the given time and rate) by which dividing the given legacy or amount, *viz.* £800 quotes 561.821 = £561 16*s* 5*d* the Anſwer.

EXAMPLE 10.

In what time will £300 amount to £373 17*s* 1*d* at £4 ½ *per Cent. per Annum.* Compound Intereſt?

3|00) 3|73.85416

By *Cor.* 3 *page* 344. 1.24 61805 the amount of £1 for the required time, which amount being found under £4 ½ *per Cent.* in the table ſhews 5 years to be the time required.

‡ Allowing 5 *per Cent. per Annum*, Compd. Intereſt.

EXAM-

EXAMPLE 11.

How long muſt £1000 be out at Compound Intereſt before it amounts to £1400 5*s* 6*d* at £4 *per Cent. per Annum?*

1000) 1400.275 (1.400275 the amount of £1 for the required time, which amount not being in either of the two tables, therefore ſeek the next leſs thereto which you will find in table 1 under £4 *per Cent.* to be 1.3685691 *viz.* the amount of £1 for 8 years at the given rate, by which amount divide the number ſought, *viz.* 1.400275 (according to the *contraction* in *page* 292) and the quotient will be 1.0231672, the neareſt leſs number to which in the ſecond table under the ſame rate is 1.0228218 anſwering to 210 days, then divide 1.0231672 (according to the ſaid *contraction*) by 1.0228218 (the amount of £1 for 210 days at the given rate) and the quotient will be 1.0003377 which anſwers in the table *nearly* to 3 days, whence the anſwer is 8 years and 213 days.

EXAMPLE 12.

At what rate *per Cent. per Annum* Compound Intereſt will £60 amount to £119 7*s* 9*d* in 20 years?

By *Cor.* 4 *page* 344.

60) 119.3875

1.9897916 the amount of £1 for 20 years, which (in the table) correſponds with £3 ½ *per cent* the anſwer.

SCHOLIUM.

Having now given ſufficient examples to explain the uſe and excellence of the two preceding tables, I ſhall in the next place give a few examples relating to *Freehold* or *Real Eſtates*, and then proceed to *Rebate or Diſcount.*

EXAM-

Example 13.

Suppose a Gentleman had £6000 in ready money, and was desirous to lay it out in the purchase of a Freehold Estate, and to be allowed £4 *per Cent.* for his money Compound Interest. What must be the annual Rent of such an Estate or purchase?

	£		£		£		£	
As	100	:	4	::	6000	:	240	the Answer.

Example 14.

Suppose a Freehold Estate of £240 *per Annum* was to be sold, and the purchaser to be allow'd £4 *per Cent.* Compound Interest. What wou'd be the purchase money and how many years purchase must the Estate be sold for?

	£		£		£		£	
First As	4	:	100	::	240	:	6000	the purchase money

	£			£	
Then As	240	year		6000	:25 the No. of years purchase
Or (without knowing the purchase money or yearly Rent) As	4	: 1	::	100	

by which multiply the annual Rent *viz.* £240, and the product will be £6000 the purchase money, as before.

Example 15.

Suppose a Gentleman bought a Freehold Estate of £240 *per Annum* for £6000, what rate of Compound Interest was he allow'd?

	£		£		£		£	
As	6000	:	240	::	100	:	4	the Answer.

Or (without knowing the annual Rent or purchaſe money) As 25 (the number of years purchaſe found in the preceding example) : £100 :: 1 year : £4 the rate the ſame as in the preceding *page*.

Note. When Freehold Eſtates are to be ſold or purchaſed in reverſion, the following examples will ſufficiently determine an explanation.

Example 16.

Suppoſe the reverſion of a Freehold Eſtate of £240 *per Annum* to commence 10 years hence was to be ſold, what is it worth allowing the purchaſer £4 *per Cent.* Compound Intereſt for his money?

Firſt (by example 14 *page* 349) As £4 : £100 :: £240 : £6000. *Then* (*per Cor.* 2 *page* 344) divide £6000 (according to the *contraction* in *page* 292) by 1.4802443 *viz.* the amount of £1 for 10 years at £4 *per Cent.* (as *per* table) and the quotient will be 4053.38497 &c = £4053 7*s* 8*d* $\frac{1}{4}$ the anſwer.

Example 17.

If the reverſion of a Freehold Eſtate to commence 10 years hence, be ſold for £4053 7*s* 8*d* $\frac{1}{4}$ and the purchaſer be allow'd £4 *per Cent.* Compound Intereſt for his money, what is the yearly Rent of the Eſtate?

Firſt (by *Cor.* 1 *page* 344) 1.4802443 *viz.* the amount of £1 for 10 years at £4 *per Cent.* as *per* table, multiplied (according to the *contraction* in *page* 287) by 4053.38497 &c. produces £6000. *Then* (*per* example 13 *page* 349) As £100 : £4 :: £6000 : £240 the annual Rent required.

REBATE, *or* DISCOUNT.

REBATE discovers to your view,
The diff'rence 'twixt a ſum that's due,
At any certain time to come,
And th' preſent worth of ſuch a ſum
Or debt, that ſhall contracted be,
As by the following rule you'll ſee.

RULE,

Th' amount of juſt one hundred pound,
For th' time, and rate, muſt firſt be found;
Then as that ſum's to th' int'reſt * net, * or £100
So is the given ſum, or debt,
To th' preſent worth, or Diſcount true,
Of th' given ſum that ſhall be due.

EXAMPLE I.

What is the Diſcount of £1000 for 10 months, at £4 *per Cent. per Annum?*

Mo.		£	
6	½	4.	Rate *per Cent.*
4	⅓		
To		2.	
Add		1.3333	
		3.3333	the Int. of £100 at the given rate for
		6	
		4	
		10	Months
Add		100.	Principal

As £103.3333 : 3.3333 :: 1000 : 32.258 = £32 5 1¾
(the Anſwer.

Example 2.

What is the present worth of a £40 note, due 15 months hence, Discount at £5 *per Cent. per Annum.*

£		£	
¼ | 5			12
1.25	} the Interest of	100	for 3 } Mths.
To 6.25			15

Add 100. Principal

£	£	£	£ s d
As £106.25 : 100 :: 40 : 37.647 &c.			= 37 12 11 ¼ (the Answer.

Or, by *Cor.* 2. in Simple Interest, *page* 331.

First 1.25 × .05 + 1 = 1.0625 *Then* divide £40 by 1.0625, and the quotient will be 37.647 &c. = £37 12*s* 11*d* ¼ the Answer, the same as above.

Example 3.

Admit I pay £37 12*s* 11*d* ¼ for a Note due 15 months hence, and am allow'd £5 *per Cent.* Discount. *Quere* the value of the Note?

The amount of the present worth is the sum to be discounted, therefore £37 12*s* 11*d* ¼ = 37.646875 × .05 × 1.25 = 2.3529 &c. the Interest of the present worth, or the Rebate of the value of the Note, to which Interest or Rebate add 37.646875 the present worth, and the sum will be 39.999 &c. = £40 nearly the value required.

Exam-

EXAMPLE 4.

Suppose I had a Legacy
Of forty pounds in cash,
Due at a certain time to come,
And sell to *Toby Flash*
The same, for what is here subjoin'd *
Th' executor t' allow †
When must the Legacy be paid
Without Rebate tell now?

	£ s d
*	37 12 11¼
†	£5 *per cent*

Solution by *Cor.* 3 in Simple Interest *page* 331.

	£	s	d		£		
From	40	—	—	=	40.		Legacy
Ded.	37	12	11¼	=	37.646875		Pr. worth
37.6468&c. × .05 =					2.353125	the	Rebate

Quote 1.25 = 1¼ Year, or 15 Months the Answer.

EXAMPLE 5.

Admit a Note or Legacy of £40 payable at 15 months hence, be sold for £37 12s 11d¼ present payment. At what rate *per Cent*, was it sold for?

Solution by *Cor.* 4 in Simple Interest *page* 332.

First £37 12s 11d¼ (the present worth) = 37.646875 which deduct from £40 (the note or legacy) and the remainder will be 2.353125 the Rebate. *Then* divide 2.353125 by 47.0585 &c. *viz.* the product arising from 37.646 &c. being multiplied by 1.25 (the time) and the quotient will be £.05 the ratio = £5. the rate required.

PROMISCUOUS QUESTIONS.

Question 1 by Mr. *James Hardy.*

What is the present worth of (or how much money paid immediately will satisfy for) £696 3*s* 9*d* due 3 years 6 months and 73 days hence; allowing Discount at £5 *per Cent. per Annum?*

	£			ys.	ms.	dys.
73*dys* $\frac{1}{5}$	5					
	3					
mo $\frac{1}{6}$	15	the Inter. of £100 at the giv. rate for		3	—	—
	2.5			—	6	—
	1.			—	—	73
To	18.5			3	6	73
Add	100	Prin.				

	£		£	£	s	d		
As 118.5 :	100	::	696.1875 :	587	10	—	the	pr. worth
	18.5			108	13	9		Rebate
			Proof	£696	3	9		

Or, by *Cor.* 2 in Simple Interest *page* 331.

First, 3 years, 6 months, and 73 days = 3.7 years *Then* $\overline{3.7 \times .05} + 1 = 1.185$ by which divide £696 3*s* 9*d* = £696.1875 and the quotient will be £587.5 = £587 10*s* the present worth, the same as above.

Question 2 by Mr. *Charles Hutton.*

What is the present worth of £120 payable as follows, *viz.* £50 at 3 months, £50 at 5 months, and the rest at 8 months, Discount at £6 *per Cent per Annum?*

Solution

Solution by *Cor.* 2 in Simple Interest *page* 331.

yrs.	yrs.	yrs.
3 mo. = .25	5 mo = .4166	8 mo. = .6666.
.06	.06	.06
Prod. .015	Prod. .025	Prod. .04

The proper divisors being found, by adding 1 to each of the above products, proceed thus

1.015)50.00(49.261

1.025)50.00(48.7804

1.04)20.00(19.2307

£ s d

£117.2721 = 117 5 5¼ Answer.

EQUATION of PAYMENTS.

OBSERVE me *Tyro*, now you'll see
Debtor and creditor agree,
When sev'ral debts are to be paid,
At diff'rent times, but after made
An Equal Payment of the whole,
Without sustaining loss—*per rule*.

RULE.

Each Payment multiply I say,
By th' time its due, and then you may
Divide the sum of th' products by
The sum of th' Payments, you'll espy.
Th' equated time, the whole's to be
Paid without loss, as here you'll see.

EXAM-

EXAMPLE 1.

Simon owes *Andrew* £80 which was to be paid £40 at 3 months and £40 at 7 months, but they agree to reduce the whole to one Payment. *Quere* the equated time?

£	mo.	£
40	× 3 =	120
40	× 7 =	280
8|0	)	40|0

Anſ. 5 months.

EXAMPLE 2.

Hugh is indebted to *Cornelius* £1000 which is to be diſcharged thus, *viz.* £200 preſent, £600 at 5 years end, and the remainder at the end of 8 years. *Quere* the equated time of Payment?

£	yrs.	£
600	× 5 =	3000
200	× 8 =	1600
1000	)	4600

Anſ. 4.6 years

EXAMPLE 3.

A Gentleman being deſirous of making a Purchaſe, borrows of a friend £460 which by agreement was to be repaid at the end of 6 months, but the Gentleman finding he had more caſh than was needful for the abovementioned purpoſe, would remit back to his friend £460 provided he would allow him a longer time for the Payment of the remainder, which being agreed upon, the time of Payment is required?

£	£
From 460	460
Take 160	6
5|00)	276|00

Anſwer 9.2 months.

EXAMPLE

Example 4.

An honeſt Man agrees to pay
One hundred Pounds a certain way,
One fourth in hand, and as we find,
The ſame each three months to his mind
Until the whole's diſcharged fair,
What is th' equated time? declare.

	mo.	£
£ 25 ×	3	75
	6	150
	9	225

100)450

Anſ. 4.5 = $4\frac{1}{2}$ months

Corollary.

When Rebate *is to be made at ſo much per Cent. per Annum.*—Find the preſent worth of each Payment for its reſpective time, the ſum of which preſent worths deduct from the whole ſum or debt and the remainder will be the Rebate or Diſcount thereof, and then by proceeding according to *Cor.* 3 in Simple Intereſt *page* 331, the *true equated time* will be eaſily known.

Example 5.

Job owes *Moſes* £200 which by agreement was to be paid as follows, *viz.* £80 at 4 months, £70 at 6 months, and the remaining £50 at the end of 9 months;

but

but they agree to have but one Payment of the whole. *Quere* the true equated time, Rebate being made at £4 *per Cent. per Annum?*

	£		£
The present worth of	80	Mths. hence will be easily found by the *rule* in p. 351 or by *Cor.* 2 p. 331 to be	78.9473
	70		68.6274
	50		48.5436

The present worth of £200, 196.1183
(payable as above

	£
From	200.
Take	196.1183

196.1183 × .04 = 7.844732) 3.8817 Rebate

Quote .4948 Parts of a year = 5 months 3 weeks and 5 days the Answer.

SCHOLIUM.

I might in this place introduce various other rules by different authors (who have endeavoured to make improvements on this common method, as given by *Cocker*,) some of which are Mr. *John Kersey*, Mr. *Hatton*, Sir *Samuel Moreland*, Mr. *Ward*, Mr. *Malcolm*, &c. but must beg to be excused as room will not permit them, and the common method being more adapted to practice, and what is generally taught in schools, and is near enough the truth in common affairs. Mr. *Malcolm*'s rule is the only true one, but very operose when the payments are to be made at different times.—This Gentleman, after putting *d* for the

the first Payment, t the distance of its term of Payment; D the last payable Debt, and T the distance of its Term, and r the rate of one year's Interest for £1, and $x =$ the distance of the equated Time; proceeds by an *algebraic* way of reasoning founded on the principles of *Simple Interest*, brings out $T + t + \frac{D + d}{dr}$ which he calls the first Number found, and $\frac{DT + dt}{dr} + Tt$ the second Number found, which two Numbers are called a and s, then (he says) $ax - x^2 = s$, whence $x = \frac{a \pm \sqrt{a^2 - 4s}}{2}$ the present rule or equated time for any two Payments.

The ingenious Mr. *Hutton* makes mention of the above rule in *page* 88 of his Arithmetic, but his examples are all worked by the common method.

PROMISCUOUS QUESTIONS.

Question 1. by Mr. *John Hampson* at *Bedford-Mill*, near *Leigh*, *Lancashire*.

From *Palladium*, 1753.

My Son having gone a considerable time to *Leigh* School at 1*s* 6*d* by the quarter, to read *English*, which commenced on the 14th of *January*, 1752: I agreeing with Mr. *Henry Arrowsmith*, the Master of the School, to pay him 4*s* by the quarter, for his writing my Son a copy or two each day besides; but he not beginning to write 'till the 19th, I would have you

you (*Palladium Arithmeticians*) ſhew the exact time when 4*s* become due to the Maſter?

Firſt to 30 the Days in the Month, add 5 the number of Days from *January* 14th, to the time he began to write, and the Sum will be 35, *Then per* Rule *p.* 355.

$$18 \times 30 = 540$$
$$35 \times 30 = 1050$$
$$s \quad d$$
$$4 = 48) \; 1590 (33\tfrac{6}{48} = 33\tfrac{1}{8}$$

from which deduct 30 and there will remain $3\frac{1}{8}$ Days the exact time to be added to the quarter.

Note. It matters not whether you take 29, 30, or 31 days to a month, the Anſwer is the ſame, as Mr. *Hampſon* juſtly remarks.

Queſtion 2. by the late *Thomas Dod*, Eſq; of *Edge*, near *Malpas*, *Cheſhire*.

Ladies Diary, 1720.

At *Michaelmas*, ſeventeen hundred nineteen,
My writings will ſhew, (which are yet to be ſeen)
That to me were three hundred and twenty pounds due,
And half of that ſum beſides forty two *viz.* £202.
Juſt five years after I then might demand, (hand;
But wou'd fain have the whole ſomewhat ſooner in
I agree to rebate for the latter ſum, too
The ſame rate (ſimple Intereſt) our ſtatutes allow,
But then I expect ſome uſe will accrue
From my ſixteen ſcore pounds, that laſt year were due.
Now to know on what day I ſhall be very fond,
To receive my five hundred and twenty-two pound?

Solution, by Mr. *Malcolm*'s Rule, given in this Treatiſe, in the preceding *page*.

Firſt, to £320 add £202 and divide the Sum by £16 (a year's intereſt of the £320) and the quotient will be 32.625 which add to 5 and the ſum will be 37.625 which (as the £320 was to be paid down) is the

the firſt number. *Secondly*, multiply 202 by 5 and divide the product by 16 and the quotient will be 63.125 the ſecond number. *Then*, from 1415.640625 the ſquare of 37.625 the firſt number, deduct 252.5 *viz.* 4 times 63.125 the ſecond number, and the remainder will be 1163.140625, the ſquare root whereof is 34.1048 which deduct from 37.625 (the firſt number) and the remainder will be 3.5202, one half of which is 1.7601 = 1 year and 277 days the true equated time, and which anſwers to *July* 4th, 1721.

SINGLE FELLOWSHIP.

BY Fellowſhip, you'll quickly find,
How Stocks in partnerſhip combin'd
Are calculated juſt and true,
And each receive his proper due.

RULE

Say, by the *Golden Rule of Three*,
As the whole Stock, whate'er it be,
Is to each partner's loſs or gain,
So is his Stock 'tis very plain;
To his partic'lar ſhare you'll find
Of loſs or gain in comp'ny join'd.

EXAMPLE 1.

Two partners, *John* and *Thomas*, make a ſtock of £240; *John* puts in £110, and *Thomas* £130, by which they gain in trade £80. What is each man's ſhare?

£
Firſt to 110 *John*'s
Add 130 *Thomas*'s } Stock

	£	£	s	d	
Then As 240 : 80 ::	110	36	13	4	*John*'s
	130	43	6	8	*Thomas*'s

} ſhare of the gain.

Proof £80

EXAMPLE 2.

Two merchants *A* and *B* make a ſtock, *A* puts in £250 and *B* £150 they trade and gain £300 which by agreement is to be ſo divided that *A* may have £6 *per Cent.* and *B* £4½. What muſt each have of the gain?

	£		£		£	s
The Int. of	250 *A*'s ſtock	at	6	per C. is	15	—
	150 *B*'s ſtock		4½		6	15

Sum 21 15

	£	s	£		£	s	d	
As	21	15	300	::	15	—	206 17 11 $-\frac{20}{29}$	*A*'s
					6	15	93 2 $-\frac{1}{4}\frac{9}{29}$	*B*'s

} ſhare

Proof £300

COROL-

COROLLARY.

When many partners are concerned the operation will be ſooner done than by the common method, by finding a pound rate, *viz.* by dividing the whole loſs or gain by the whole ſtock, and the quotient will be a common multiplier or pound rate, by which multiply each partner's ſhare of the ſtock, and the product will be his ſhare of the loſs or gain.

EXAMPLE 3.

Suppoſe three Cheeſemongers *A B* and *C* had 180 tons of cheeſe on board a ſhip at Sea, *A*'s was 84 tons, *B*'s 61, and *C*'s 35, but unfortunately being diſtreſſed in a ſtorm, they were obliged (in order to lighten the ſhip) to caſt $\frac{3}{5}$ of the loading overboard. What does each man ſuſtain of the loſs?

Firſt, $\frac{3}{5}$ of 180 = 108 the whole loſs. *Then*, (by the abovementioned *Cor.* divide 108 by 180 and the quotient will be .6 for a common multiplier.

$$\left.\begin{matrix}84\\61\\35\end{matrix}\right\} \times .6 = \left\{\begin{matrix}50.4\\36.6\\21\end{matrix}\right\} \text{Tons} = \left\{\begin{matrix}T. & C.\\50 & 8\ A\text{'s}\\36 & 12\ B\text{'s}\\21 & -\ C\text{'s}\end{matrix}\right\} \text{Loſs.}$$

Proof 108 — whole

EXAMPLE 4.

In honour of *Criſpin* the Cordwainers they
Prepared a Feaſt to be jovial and gay,
Six Tanners, eight Curriers at firſt took their place,
Sixteen Cordwainers next, all with reg'lar grace,
Then the Coblers next, who were twenty and one,
At table ſat down with their hoſt merry *John*:
When dinner was over full bumpers did paſs,
Some drank a full noggin and ſome a wide glaſs,

Carouſing and ſinging they paſt the long day,
No ſons of great *Bacchus* more jovial than they.
At laſt for the reck'ning the Tanners did call,
Whilſt ſome of the Coblers did nothing but bawl
For old *Hock*, or *Stingo*—the Landlord came in
With his ſcores round a trencher—to work did begin,
And found that ten pounds was the ſhot to defray,
Then tell to me *Tyro* what each had to pay,
When the Tanners and th' others agreed very true,
In proportion to pay, as five, four, three and two?

It is evident by the queſtion that as oft as each Tanner paid 5*s*, the others paid 4*s*, 3*s*, and 2*s* a piece, which ſum multiply by the number of each trade, or occupation.

s		*s*		*£*
6	×	5	=	30 = 1.5
8		4		32 = 1.6
16		3		48 = 2.4
21		2		42 = 2.1
				152 = 7.6

Per Cor. in the preceding *page*.

7.6)10.0(1.31578
Com. Multiplier.

£		*£*		
1.31578 ×	1.5	=	1.97367	the 6 Tanners
	1.6		2.105248	8 Curriers
	2.4		3.157872	16 Cordwainers
	2.1		2.763138	21 Coblers

Share.

£	*£*	*s*	*d*	
6)1.97367	(.328945	6	$6\frac{3}{4}+$	Tanner's
8)2.105248	(.263156	5	3+	Currier's
16)3.157872	(.197367	3	$11\frac{1}{4}+$	Cordwainer's
21)2.763138	(.131578	2	$7\frac{1}{4}+$	Cobler's

each Share.

EXAM-

EXAMPLE 5.

An Uſurer dying, left the whole of his Fortune to be diſpoſed of in the following manner: To *A* $\frac{2}{5}$, to *B* $\frac{3}{10}$, to *C* $\frac{1}{8}$, to *D* $\frac{1}{20}$, to *E* $\frac{1}{40}$, and to *F* $\frac{1}{50}$, and the remainder which was £800 to *C* (over and above his $\frac{1}{8}$). What was the whole Sum left, and each one's Share thereof?

$\frac{2}{5}$, $\frac{3}{10}$, $\frac{1}{8}$, $\frac{1}{20}$, $\frac{1}{40}$, $\frac{1}{50}$ = .4, .3, .125, .05, .025, .02

Sum .92 — Parts of £1.

	£
From	1.
Take	.92
	.08) 800.00

£10000 the whole Sum left.

			£	
£10000 mult. by	.4	=	4000	*A*'s
	.3	=	3000	*B*'s
	.125	=	1250	*C*'s
			800	*C*'s
£10000 mult. by	.05	=	500	*D*'s
	.025	=	250	*E*'s
	.02	=	200	*F*'s
		Proof	£10000	

Share.

Or thus,

The ſhares or fractions in th
$\frac{1}{8}$, $\frac{1}{20}$, $\frac{1}{40}$, and $\frac{1}{50}$, reduced to a
(by the *note* to *caſe* 9 *page* 251
$\frac{10}{200}$, $\frac{5}{200}$, and $\frac{4}{200}$, whereby
divided into 200 equal parts, w
C's 25, (excluſive of his £800)
which being added together a
deducted from $\frac{200}{200}$ or the whol
equal (by the queſtion) to £80

be $\frac{100}{16} = £50$ which multiplied ſeverally by 200, 80, 60, 25, 10, 5 and 4, and adding the £800 to the product had by multiplying by 25, will produce the whole Sum left, and each one's reſpective Share thereof, the ſame as in the preceding *page*.

Note. The above Queſtion I propos'd in *Owen's* Magazine for *December* 1764, from whence Mr. *Birks* copied it into his Arithmetic, *page* 594.

Example 6.

A *Miſer* left his ſervant *Joe*,
One hundredth of his ſtore,
Which made the ruſtic's boſom glow,
When counting of it o'er.
Then with one twentieth of his chink,
To landlord *Belch* he goes,
And with a *Tinker* ſits to drink,
And his dear blooming *Roſe*.
He lent the *Tinker* from this Sum,
Two tenths, it was no more,
Three fifths he paid the Tapſter *Tom*,
Before he went on ſcore;
One fortieth gave a Fidler *plus*,
To play a merry tune,
Three ſixtieths *Nan* to have a buſs,
At four i'th' afternoon.
Then half a crown he gave his *Fair*,
To pay for cakes and ſpice,
Who dainty cordials does prepare,
She being ſo very nice.
Three eightieths of his legacy,
He left with *Belch* on ſcore;
So *Tyro* now diſplay your art,
And ev'ry Sum explore?

Firſt

Firſt $\frac{2}{10}=\frac{1}{5}$, and $\frac{3}{60}=\frac{1}{20}$ *Then* the fractions $\frac{1}{5}$, $\frac{3}{5}$, $\frac{1}{40}$ and $\frac{1}{20}$ added together make $\frac{7}{8}$ which by the queſtion is equivalent to all the money *Joe* took with him except the half crown he gave his *Fair*, therefore it is very plain that half a crown muſt be the remaining $\frac{1}{8}$, conſequently 8 half crowns $=£1$ was the money he took with him, $\frac{2}{10}$ or $\frac{1}{5}$ whereof $=4s$ he lent the *Tinker*, $\frac{3}{5}=12s$ he paid the *Tapſter*, $\frac{1}{40}=6d$ he gave the *Fidler*, and $\frac{3}{60}$ or $\frac{1}{20}=1s$ he gave to *Nan*, which ſeveral Sums added to the half crown he gave his *Fair* make £1 (as before) which being the $\frac{1}{20}$ of his Legacy, therefore the whole Legacy muſt be £20, $\frac{3}{8}$ of which $=15s$ he left on ſcore, and the whole Legacy being $\frac{1}{100}$ of the *Miſer*'s Store (as *per* queſtion) therefore $20\times100=£2000$ was the *Miſer*'s whole Eſtate.

Promiscuous Queſtions.

Queſtion 1. by Mr. *Jeake*.

It is propoſed to divide £300 among 3 perſons ſo that *A* gets £6 more than $\frac{1}{2}$, *B* £12 more than $\frac{1}{3}$, and *C* £8 leſs than $\frac{2}{3}$. What is the equal Share of each?

		£			£			£
and	To	150	the $\frac{1}{2}$	of £300	add 6	and the Sum	will be	156
	to	100	the $\frac{1}{3}$		add 12	and the Sum	will be	112
	from	200	the $\frac{2}{3}$		take 8	and the Rem.	will be	192

Total £460 but

the Sum propos'd to be divided is only £300 therefore

	£	£		£	s	d	
As 460 : 300 ::	156	:		101	14	$9\frac{1}{4}\frac{3}{23}$	*A*'s
	112			73	4	$10\frac{1}{4}\frac{17}{23}$	*B*'s
	192			125	—	$4-\frac{16}{23}$	*C*'s
				Proof £300	—	—	Share.

Queſ-

Queſtion 2.

From the Town and Country Magazine for *April* 1769.

Five Weavers, four Taylors, and three Millers, drank to the value of £5 which they agreed to pay in the following manner, *viz.* $\frac{2}{5}$ of what the Weavers paid ſhould be equal to $\frac{7}{8}$ of what the Taylors paid, and $\frac{5}{6}$ of what the Taylors paid ſhould be equal to $\frac{3}{4}$ of what the Millers paid. *Quere*, what did the men of each Trade pay?

£ £
then (*per* Qu.) $\frac{2}{5}$ divided by $\frac{7}{8}$ = $\frac{16}{35}$ will be the { Weavers
and $\frac{5}{6}$ of $\frac{16}{35}$ divided by $\frac{3}{4}$ = $\frac{32}{63}$ will be the { Taylors / Millers } Share.

The ſum of which ſhares is £1 $\frac{304}{315}$ = $\frac{619}{315}$ but the Sum ſpent was £5, therefore

£ £ £ £ s d
As $\frac{619}{315}$: 5 :: 1 : 2 10 $10\frac{1}{2}$ $\frac{402}{619}$ the { Weavers
$\frac{16}{35}$: 1 3 3 $\frac{396}{619}$ { Taylors
$\frac{32}{63}$: 1 5 10 $\frac{440}{619}$ { Millers } true Share.

Proof £5 — — the Sum ſpent.

Queſtion 3. by Mr. *Richard Carr*.

There is in a Cathedral Church, 20 Canons and 30 Vicars, and they ſpend in a year £2600, but every Canon muſt have 5 times as much as a Vicar. How much is each man's yearly Income?

Firſt, 20×5 = 100, and 100+30=130 *Then*

£ £ £
As 130 : 2600 :: { 100 / 30 } : { 2000 / 600 } for the { 20 Canons / 30 Vicars

£ £
20)2000(100 } the yearly income of each { Canon
30) 600(20 } { Vicar

DOU-

DOUBLE FELLOWSHIP.

THIS Rule determines very fair,
At diff'rent times each partner's Share
How each one finds his loſs or gain,
As underneath I ſhall explain.

RULE.

Each partner's Stock firſt multiply
By th' time he does the ſame employ;
Then as th' Sum of theſe products be,
To the whole gain or loſs you'll ſee,
So is each of theſe products true,
To each man's gain, or loſs in view.

EXAMPLE I.

Two Partners *A* and *B* enter into partnerſhip, *A* puts in £80 for 7 months, and *B* £90 for 5 months, they traffic and gain £40. How muſt it be divided between them?

$$\left.\begin{matrix}\textit{First}, 80\\ \text{and } 90\end{matrix}\right| \times \left|\begin{matrix}7\\5\end{matrix}\right| = \left|\begin{matrix}560\\450\end{matrix}\right| \text{the product of} \left|\begin{matrix}A\text{'s}\\B\text{'s}\end{matrix}\right| \text{ſtock \& time.}$$

Sum 1010

$$\textit{Then} \text{ as } 1010 : \overset{\pounds}{40} :: \left|\begin{matrix}560\\450\end{matrix}\right| : \left|\begin{matrix}\overset{\pounds}{22} & \overset{s}{3} & \overset{d}{6\tfrac{3}{4}\tfrac{9}{101}} & A\text{'s}\\ 17 & 16 & 5\ \tfrac{92}{101} & B\text{'s}\end{matrix}\right| \text{ſhare of the gain.}$$

Proof £40 — —

EXAM-

Example 2.

Three Butchers whoſe names we'll call *A*, *B* and *C*,
To hire a lea paſture together agree,
Juſt forty bright guineas *per annum* to pay,
To feed their cows jointly, as under we'll ſay;
A put in eight cows four months to a day,
And *B* put in ten cows three months and no more,
And *C* five for twelve months, then *Tyro* explore
What each of the annual Rent had to pay,
Come do me this quickly no longer delay?

First and $\left\{\begin{matrix}8\\10\\5\end{matrix}\right\} \times \left\{\begin{matrix}4\\3\\12\end{matrix}\right\} = \left\{\begin{matrix}32\\30\\60\end{matrix}\right\}$ the prodct. of $\left\{\begin{matrix}A's\\B's\\C's\end{matrix}\right\}$ Stock and Time.

Sum 122

				£	s	d		
Then As	122 :	£ 42 : :	32 :	11	—	$3\frac{3}{4}\frac{45}{61}$	*A's*	Part of the Rent.
			30 :	10	6	$6\frac{1}{2}\frac{46}{61}$	*B's*	
			60 :	20	13	$1\frac{1}{4}\frac{11}{61}$	*C's*	
		Proof		£ 42	—	—		

Note. The Product of *C*'s Stock and Time being exactly double to *B*'s, makes *C* to pay exactly twice as much as *B*.

Example 3.

A perſon dying left to four of his relations *A*, *B*, *C* and *D*, £140. *A* was to receive £50, *B* £40, *C* £30 and *D* £20, when each one had received his legacy, they agreed to make a Stock of the whole; *A* put his ſum in for 6 months, *B* for 9 months, *C* for 12 months, and *D* for 15 months, by which they gain £200. What muſt each man receive of the gain in proportion to his Stock and the Time of employing it?

When

When many partners are concern'd it will be better to find a pound rate or common multiplier, as before taught in *Single Fellowship, page* 363, *viz.* by dividing the whole loss or gain by the sum of the products, and the quotient will be a pound rate, by which the product of each man's stock and time being multiplied, will produce his share of the loss or gain.

See the following Operation.

$$\left.\begin{matrix}50\\40\\30\\20\end{matrix}\right\}\times\left\{\begin{matrix}6\\9\\12\\15\end{matrix}\right\}=\left\{\begin{matrix}300\\360\\360\\300\end{matrix}\right\}\text{the prodt. of}\left\{\begin{matrix}A\text{'s}\\B\text{'s}\\C\text{'s}\\D\text{'s}\end{matrix}\right\}\text{Stock and Time.}$$

$$1320)\overset{\pounds}{200.0}(.151515\ \text{Com. Multiplier.}$$

$$.151515\times\left\{\begin{matrix}\overset{\pounds}{300}\\360\end{matrix}\right\}=\left\{\begin{matrix}45.4545\\54.5454\end{matrix}\right\}=\left\{\begin{matrix}\overset{\pounds}{45} & \overset{s}{9} & \overset{d}{1} & A\text{'s}\\54 & 10 & 10\tfrac{3}{4} & B\text{'s}\end{matrix}\right\}\text{share of the gain.}$$

And as the Prod. of $\left\{\begin{matrix}A\text{'s}\\B\text{'s}\end{matrix}\right\}$ Stock and Time is equal to $\left\{\begin{matrix}D\text{'s}\\C\text{'s}\end{matrix}\right\}$ consequently their Gain must be equal also.

Example 4.

Five merchants *A B C D* and *E* companied and made a Stock of £4000

$$\left.\begin{matrix}A\text{'s}\\B\text{'s}\\C\text{'s}\\D\text{'s}\\\text{and } E\text{'s}\end{matrix}\right\}\text{Money was in}\left\{\begin{matrix}4\\6\\8\\10\\12\end{matrix}\right\}\text{Months}$$

whereby they gained £1400, which was divided in such manner that

$$\text{and}\left\{\begin{matrix}\frac{1}{2}\\\frac{1}{3}\\\frac{1}{4}\\\frac{1}{5}\end{matrix}\right\}\text{of}\left\{\begin{matrix}A\text{'s}\\B\text{'s}\\C\text{'s}\\D\text{'s}\end{matrix}\right\}\text{Gain was equal to}\left\{\begin{matrix}\frac{1}{3}\\\frac{1}{4}\\\frac{1}{5}\\\frac{1}{6}\end{matrix}\right\}\text{of}\left\{\begin{matrix}B\text{'s}\\C\text{'s}\\D\text{'s}\\E\text{'s}\end{matrix}\right\}\text{Gain}$$

Quere, what did each merchant gain and put in?

First,

Firſt, If *A*'s Gain be ſuppoſed to be 2, then *B*'s will be 3, *C*'s 4, *D*'s 5, and *E*'s 6, which added together make 20. *Then*

	£	£	
As £ 20 : £ 1400 ::	2	140	*A*'s
	3	210	*B*'s
	4	280	*C*'s
	5	350	*D*'s
	6	420	*E*'s

Gain.

Now having proceeded ſo far we have the whole Stock, each man's Gain and Time given, to find each man's particular Stock, which is eaſily obtained by the following general

RULE.

Multiply * each man's Loſs or Gain * continually
By each one's Time except his own,
This done—ſay by the *Rule of Three;*
As th' Sum of all theſe products be
To the whole Stock—ſo is you'll find,
Each of theſe Products ſo combin'd
To each man's Stock—be't leſs or more,
That you in numbers muſt explore.

140	×	6	×	8	×	10	×	12	=	806400
210		4		8		10		12		806400
280		4		6		10		12		806400
350		4		6		8		12		806400
420		4		6		8		10		806400
										4032000

As

£ £

As 4032000 : 4000 :: 806400 : 800 the Stock each Merchant advanced, for as the products are all *equal* the Stocks muſt be *equal alſo*, ſo that divide £4000 (the whole Stock) by 5 (the number of perſons) and the quotient will be £800, *viz.* each one's Stock the ſame as above.

Or, Divide each perſon's gain by the time his money was in, and the quotients will be £25 the gain of each perſon for a month. *Then*, As 25 × 5 = 125 the ſum of the gains *per* month, is to £4000 the whole Stock, ſo is £25 each man's monthly gain to $\frac{1}{5}$ of £4000 = £800 each perſon's Stock, as before.

Promiscuous Questions.

Question 1.

Taken from Hill's Arithmetic, *page* 284; *to which Mr.* Hill *has given* a very wrong Solution, *as many* Authors *do to Queſtions of this kind.*

A, *B* and *C*, company and put in together £3822. *A*'s money was in 3 months, *B*'s money was in 5 months, and *C*'s money was in 7 months: They gained £234, which was ſo divided as the $\frac{1}{2}$ of *A*'s Gain was equal to $\frac{1}{3}$ of *B*'s Gain, and $\frac{1}{3}$ of *B*'s Gain was equal to $\frac{1}{4}$ of *C*'s Gain: What did each merchant gain and put in?

If *A*'s Gain be ſuppoſed to be 2, then by the tenor of the Queſtion *B* muſt have 3 and *C* 4, which added together make 9. *Then*

£ £

As 9 : 234 :: { 2 / 3 / 4 } : { 52 *A*'s / 78 *B*'s / 104 *C*'s } Gain

234 whole

Now we have the whole Stock, each man's Gain and Time given to find each man's particular Stock, to do which proceed according to the *Rule* given in *page* 372, and the work will ſtand as under.

$52 \times 5 \times 7 = 1820$
$78 \times 3 \times 7 = 1638$
$104 \times 3 \times 5 = 1560$
Sum 5018 } Products

	£		£	s	d	
As 5018 : 3822 ::	1820	:	1386	4	$4 - \frac{176}{193}$	*A*'s
	1638	:	1247	11	$11 - \frac{4}{193}$	*B*'s
	1560	:	1188	3	$8\frac{3}{4} \frac{13}{193}$	*C*'s

Proof £3822 — — the whole } Stock.

Or thus,

	£	£		
3) 52	$17\frac{1}{3}$	$17\frac{35}{105}$	*A*'s	
5) 78	$15\frac{3}{5}$ =	$15\frac{63}{105}$	*B*'s	Gain *per* month.
7) 104	$14\frac{6}{7}$	$14\frac{90}{105}$	*C*'s	
Sum	$47\frac{83}{105}$			

As £$47\frac{83}{105}$: £3822 :: £$17\frac{35}{105}$, $15\frac{63}{105}$, $14\frac{90}{105}$: *A*'s, *B*'s, *C*'s Stock, the ſame as above.

Note. Mr. *Hill* (in his Arithmetic *page* 285) makes each one's Stock to be as under, *viz.*

	£		£	s	d	
A's	468	inſtead of	1386	4	$4 - \frac{176}{193}$	the true Stock found as above.
B's	1170		1247	11	$11 - \frac{4}{193}$	
C's	2184		1188	3	$8\frac{3}{4} \frac{13}{193}$	

Queſ-

Queſtion 2. by *Buteo*, (Publiſh'd near 200 Years ago.)

A Merchant's real Stock being £120 and the Factor's £60, they agreed that at the year's end the Factor ſhould have $\frac{1}{2}$ of both Stock and Gain, but they broke up at 8 month's end having gained £150. How much ought the Factor to have?

First, £120 + £60 = £180 the whole Stock, half of which is £90 each man's ſhare thereof at the year's end, whereby it is plain that had the Stock continued in trade during that time, the Factor muſt have had £30 of the Merchant's Stock, but as it continued only 8 months or $\frac{2}{3}$ of a year, therefore $\frac{2}{3}$ of £30 = £20 is the Factor's ſhare of the Merchant's Stock, which ſhare

being { taken from £120 leaves £100 } the { Merch't's
added to £60 makes £80 } the { Factor's
Stock at the 8 months end or time of breaking up.

2dly. As £180 : £150 :: | £100 / £80 | : | £ s d: 83 6 8 / 66 13 4 | the | Merch't's / Factor's | gain.

Then, £100 and £80 | + | £ s d: 83 6 8 / 66 13 4 | = | £ s d: 183 6 8 / 146 13 4 | the | Mert's / Fact's | Share of the whole.

BARTER.

BARTER, diſcovers you will ſee,
The worth of each commodity,
That is exchang'd, or truck'd in trade,
The terms be what they will that's made,
And no one party, loſs ſuſtain,
As underneath I ſhall explain.

RULE.

First find the value of what's ſold,
Whoſe given quantity is told,
Then for this worth you muſt find true,
What quantity o'th' other's due,
At th' given rate, and then you may
An anſwer find without delay.
When goods are rated ſomething more
Than ready money price, be ſure,
Proportion thus—now to go on
As th' ready money price of one,
Is to its Bart'ring price, I ſay,
So is the money price alway
Of th' other to its Bart'ring price,
This done, now *Tyro* in a trice;
You'll quickly find the quantity,
O'th' party's laſt commodity;
From th' ready money, (mind me ſtill)
Or Bart'ring price, be what it will.

EXAMPLE I.

Suppoſe I have 300 yards of linen Cloth, worth 18*d* *per* yard, which I would truck for Cheeſe at 32*s* *per* *C.* of 120*lb* to the *C.* How much Cheeſe muſt I receive for my linen Cloth?

d	£		*s*	*d*	
6 | ¼ |	30.0		2	—	
Deduct	7.5		—	6	
		the Price of the Linen at	1	6	*per* yard
s £	2)22.5				
32 = 1.6					
	.8)11.25		—	9	

qr *lb*

Anſwer, *C* 14.0625 = *C* 14 — 7 ½

EXAM-

Example 2.

A, and *B* Barter, *A* hath 200½ yards of Kersey at 9*s* 6*d* *per* yard; *B* hath 80 yards of Velvet at 1 guinea *per* yard. *Quere*, which must pay balance, and how much?

		£	s	d			£	s	d	
10*s*	½	200	10	–	the value of the	Kersey at	1	–	–	*per* Yard
6*d*	$\frac{1}{20}$	100	5	–			–	10	–	
Deduct		5	–	3			–	–	6	
From		95	4	9			–	9	6	
Take		84	–	–		Velv. at £1 1*s*				
Rems.		£11	4	9		Kersey more than the Velvet which must be paid by *B* to *A*.				

Example 3.

A Farmer sold to a Maltster 364 bushels of Barley at 3*s* 8*d* *per* bushel, for which he received by agreement 50 bushels of Malt and £54 6*s* 9*d* in Cash, What was the Malt valued at *per* bushel?

		£	s	d			£	s	d	
4*s*	⅕	364	–	–	the value of	the Barley at	1	–	–	*per* Bushel
4*d*	$\frac{1}{12}$	72	16	–			–	4	–	
Deduct		6	1	4			–	–	4	
From.		66	14	8			–	3	8	
Dedt.		54	6	9		the Malt	Cash receiv'd			
50	5)	12	7	11						
	10)	2	9	7		10 Bushels	thereof.			
Answer		*s*4	11½			1 Bushel				

Example 4.

C, hath Corn at five ſhillings *per* buſhel, not more,
But in Barter will have juſt one third of a ſcore.
D, a *Manchester* Tradeſman, hath Fuſtians we find,
Worth in ready money the ſum here ſubjoin'd. *
Then how much *per* yard muſt the Fuſtian by *D*,
Be rated equivalent with *C*'s to agree?

As 5*s* the ready Money price of the Corn, is to 6*s* 8*d* the bartering price, ſo is 2*s* 9½*d* the ready money price of the Fuſtian, to 3*s* 8½*d* ⅔, the bartering price thereof.

Promiscuous Questions.

Queſtion 1. by Mr. *John Saxton.*

(See his Arithmetic *page* 289.)

A and *B* Barter, *A* has 1375 yards of Shalloon at 19*d per* yard, for which *B* gives him broad Cloth at 17*s* 4*d per* yard, and a Bill of £50 due 6 months hence. How many yards muſt *A* give *B* beſides the Bill?

		£	s	d
1*s*	1/20	1375	—	—
6*d*	1/2	68	15	—
1*d*	1/6	34	7	6
		5	14	7
From		108	17	1
Dedt. †		48	15	7¼
Rems.		£60	1	5¾

the value of the

	£	s	d
Shalloon at	1	—	—
	—	1	—
	—	—	6
	—	—	1
per yard	—	1	7

£50 Bill diſcounted.
Broad Cloth at 17*s* 4*d p.* yd.

As 17*s* 4*d*: 1 yd. :: £60 1*s* 5*d* ¾: 69 yds. 5 nls. Anſr.

---

* 2*s* 9½*d per* yard.

† The preſent worth of the Bill is eaſily known by proceeding according to *Cor.* 2 in Simple Intereſt *page* 331, or by the Rule in *page* 351, thus, As £102 10*s* (the amount of £100 for 6 months at lawful Intereſt) is to (its principal, or preſent worth) £100 ſo is £50 (the value of the Note) to £48 15*s* 7*d* ¼ the preſent worth, as above.

Queſ.

Question 2. by Mr. *Hatton.*

Two Merchants have various kinds of goods to Barter. *A* hath 735 yards of *Indian* Silk at 8*s* 6*d per* yard ready money, and in Barter 10*s*, also 532 Canes at 3*s* a piece ready money, and in Barter 3*s* 4*d*, and 16 pieces of Muslin at £4 a piece ready money, and in Barter £4 10*s*. *B* hath scarlet Cloth at £1 *per* yard ready money; Glass Manufacture at 1*s* 8*d per* pound ready money, and a finer kind at 2*s* 4*d per* pound. How many yards of Cloth and pounds of each kind of Glass of all alike number must *B* give *A* advancing his goods proportionally also in Barter?

		s	d		£	s	d
A's	Silk, 735 yds. at	8	6 *per* yd.	comes to	312	7	6
	Canes, 532 at	3	a piece		79	16	—
	Muslin, 16 pieces at	£4	a piece		64	—	—
				Sum	£456	3	6

			£	s	d
The price of 1 yd / lb / lb of *B*'s	Scarlet Cloth.		1	—	—
	Glass Manufac.		—	1	8
	finer sort.		—	2	4
		Sum	£1	4	—

Now divide 109482 the pence in £456 3*s* 6*d* by 288 the pence in £1 4*s*, and the quotient will be $380\frac{42}{288} = 380\frac{7}{48}$ the Answer.

LOSS *and* GAIN.

BY *Loss and Gain*, you're learned fair,
To act with Justice and prepare
The price of each commodity,
In such proportion to agree
That no one injured shall be,

When-

Whene'er the Loss or Gain is given
O'th' quantity be't odd, or even,
To find th' value of any part
Thereof, pray get this Rule by heart.

RULE.

First say as the whole quantity
Of goods, or ware, whate'er they be,
Is to the sum of Cost and Gain,
So's any part I will maintain,
Of the said goods be what they will,
To th' price they're sold for,—mind me still,
And when the Gain or Loss is found
So much *per Cent.*—one hundred pound
Add to the Gain, if Loss subtract,
To make your second term exact.

EXAMPLE 1.

Admit a Cheesemonger buys 8 Ton, 12 C. 3 qrs. 8 lb of Cheese, at £1 14*s* 6*d* *per* C. and sells it out again at £2 3*s* 9*d* *per* C. What does he Gain upon the whole?

	£	*s*	*d*						
First from	2	3	9	the	Selling Price of a C.				
Take	1	14	6		Prime Cost				
C						*T*	*C*	*q*	*lb*
Then, As 1 is to	–	9	3		Gain of a *C*. so is	8	12	3	8

to £79 18*s* 7*d* the Answer.

EXAMPLE 2.

If two pence three farthings *per* Shilling I gain,
My profit *per Cent.* *Tyro* to me explain?

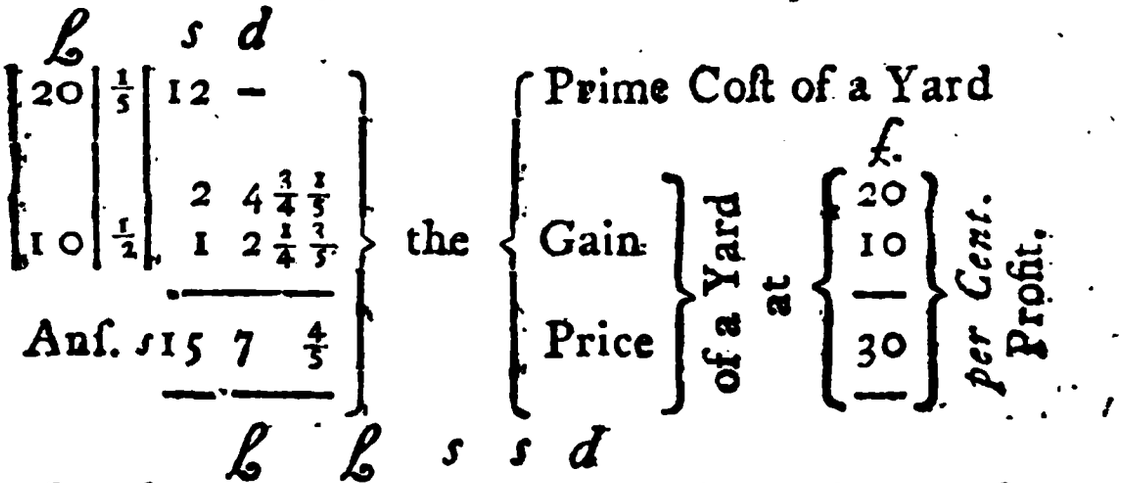
d		£	*s*	*d*		*d*	
3	$\frac{1}{4}$	100	–	–	the Gain *per Cent.* at	12	*per* Shilling Profit.
$\frac{1}{4}$	$\frac{1}{12}$	25	–	–		2	
Deduct		2	1	8		$\frac{1}{4}$	
Rems.		£22	18	4		$2\frac{3}{4}$	
s	*d*	£	£	*s*	*d*		

Or, As 1 : $2\frac{3}{4}$ :: 100 : 22 18 4 the Answer as above.

EXAM-

EXAMPLE 3.

If Cloth for twelve Shillings *per* yard I can buy,
Then how muſt I ſell it be pleas'd to deſcry,
To gain thirty *per Cent.* for the uſe of my caſh,
Should I happen to ſell it to *Timothy Flaſh?*

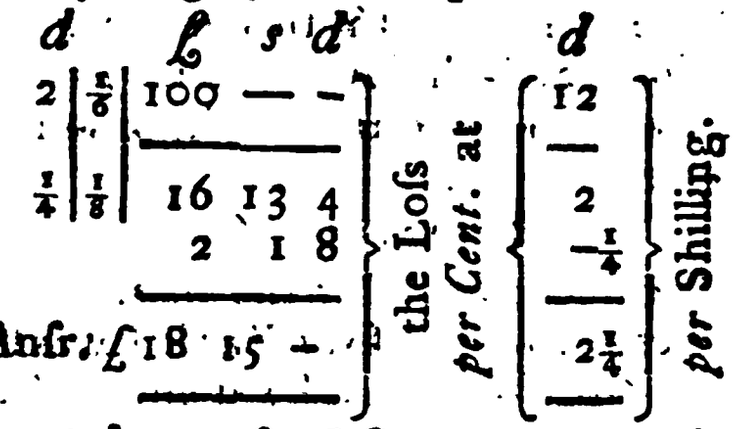


£ £ s s d

Or, As 100 : 130 :: 12 : 15 7 — 4/5 the Anſwer as above.

EXAMPLE 4.

By damaged Stockings ſuppoſe I ſhould loſe,
Nine farthings *per* Shilling by ſelling my Hoſe,
Then how much *per Cent.* ſhould I loſe by my Ware,
Ingenious young *Tyro,* — be pleas'd to declare.



s d £ £ s

Or, As 1 : 2 1/4 :: 100 : 18 15 the Anſwer as above.

EXAMPLE 5.

Suppoſe a *Mancheſter* Tradeſman buys Yarn, to the value of £240, and ſells the ſame out again immediately for £254 10s 6*d* with 6 months Credit. What does he gain *per Cent?*

Firſt,

Firſt, From £*248 6ſ 4d the preſent worth of £254 10ſ 6d, (being what the Yarn was ſold for at 6 months Credit) deduct £240 (the prime Coſt) and there will remain £8 6ſ 4d, the Gain upon the whole.

£ £ s d £ £ s d

Then, As 240 : 8 6 4 :: 100 : 3 9 3½ the Anſwer.

Or, As £240 (the prime Coſt of the Yarn) is to £14 10ſ 6d (the whole Gain had there been no Credit,) ſo is £100 to £6 1ſ –d½ the Gain *per Cent.* had the Yarn been ſold for ready Money, but 6 months Credit being given, therefore deduct the Rebate of £106 1ſ –d½ for 6 months, (which will be eaſily found by the *Rule* in *page* 351) from £6 1ſ –d½ and there will remain £3 9ſ 3d½ the Anſwer the ſame as before.

Remark.

Some Authors take Queſtions of this kind in a different ſenſe, and would ſolve the preceding Queſtion thus, £ *Gain* £ *Gain*

As 240 : 14.525 :: 100 : 6.052. and then ſay

Mon. Gain Mon. Gain £ s d

As 6 : 6.052 :: 12 :: 12.104 = 12 2 1. which they would call the Anſwer: In this manner Mr. *Birks* ſolves Queſtion 23, in his Arithmetic, *page* 378, but this method (according to the conditions of the Queſtion) is *very* erroneous.

Example 6.

A *Sportſman* courſing near the Banks of *Dee*,
Up bounces *Puſs*—juſt ſixty Yards † was ſhe
Before the Dog,—but *Smoker* dont her ſee

---

* *Note.* The preſent worth of £254 10ſ 6d for 6 months at lawful Intereſt is eaſily found by *Cor.* 2 in Simple Intereſt, *page* 331, or by the *Rule* in *page* 351 to be £248 6ſ. 4d as above.

† *i. e.* Sixty Yards before the Greyhound at her firſt getting up.

'Till

'Till fifty ſeconds were elaps'd, not more,
Then *John* eſpies her, and cries out *To-ore*,
Now *Smoker* ſkims along the chequer'd Plains,
The woods reſound to th'em'lous *Sportſman*'s ſtrains.
Poor *Puſs* is taken, and the Chaſe is done,
The Time aſcertain, and what Ground was run;
When *Smoker* leap'd at twenty miles *per* hour,
And *Puſs* juſt at the rate of four times four.

Hour Miles Seeds Yards

Firſt, As 1 : 16 :: 50 : $391\frac{1}{9}$ which add to 60 and the Sum will be $451\frac{1}{9}$ yards the Diſtance the Hare had at ſtart. Now as (by the Queſtion) the Dog's rate was 4 miles an hour more than the Hare's, therefore

Miles Hour Yards Min Secds
As 4 : 1 :: $451\frac{1}{9}$: 3 $50\frac{15}{22}$ } the Time. } ran by the Dog.
Hour Miles Min Secds Yards
Then As 1 : 20 :: 3 : $50\frac{15}{22}$: $2255\frac{5}{9}$ } the Diſt. } ran by the Dog.

But the Diſtance ran by the Dog may be eaſily found without knowing the Time he ran, for it is plain by the Queſtion, that in running 20 miles he would gain 4 *viz.* $\frac{1}{5}$, conſequently $451\frac{1}{9}$ yards (the Diſtance the Hare had at ſtart) muſt be $\frac{1}{5}$ of the

Yards
Chaſe, and 5 times $451\frac{1}{9}$ = $2255\frac{5}{9}$ } the Diſt. } as above.
Miles Hour Yards Min Secs
And *then* As 20 : 1 :: $2255\frac{5}{9}$: 3 $50\frac{15}{22}$ } the Time } as above.

Note. The above Queſtion I propos'd many years ago, and inſerted it in a Miſcellany of Poems and Mathematical Articles which I publiſhed in the year 1768; and as both Loſs and Gain are concerned in the Queſtion, I thought it might very properly come under the denomination of this Rule.

PRO-

PROMISCUOUS QUESTIONS.

Queſtion 1. by Mr. *Webſter.*

See the ſecond Edit. of his Arithmetic, *page* 32.

If by ſelling Cloth at 5*s per* Ell I gain £8 *per Cent.* What ſhall I gain *per Cent.* if I ſell the Ell at 6*s* 3*d*?

	£
Firſt to	100
Add	8

s — *s d* £

Then As 5 : 108 :: 6 3 : 135, from which deduct £100 and there will remain £35 the Anſwer, which in Mr. *Webſter*'s Arithmetic is only £10.

Note. This and the four following Queſtions Mr. *Vyſe* has taken into his Arithmetic, becauſe their Authors have ſolved them wrong, the Error conſiſts in the ſtating of the Queſtions, by making the Gain or Loſs of £100 the ſecond term inſtead of its Amount.—Mr. *Hutton* likewiſe remarks upon theſe Queſtions, but as neither of theſe ingenious Gentlemen have ſhewn the young *Tyro* how to proceed properly to ſolve them, I therefore thought it neceſſary to give them a place in this Treatiſe.

Queſtion 2. by Mr. *Stonehouſe.*

See the ſecond Edit. of his Arithmetic, *page* 103.

At 5*s per* Dozen I gain £7 10*s per Cent.* how much ſhall I gain *per Cent.* if I ſell the Dozen at 5*s* 9*d*?

s £ *s* *s d* £ *s d*

As 5 : 107 10 :: 5 9 : 123 12 6. from which deduct £100 and there will remain £23 12*s* 6*d* the Anſwer, which in Mr. *Stonehouſe*'s Arithmetic is only £8 12*s* 6*d*.

Queſ-

Queſtion 3. by Mr. *Hill.*

See the 10th Edition of his Arithmetic, *page* 289.

A *Mancheſter* Chapman going to a Fair, ſold Fuſtians for 11*s* 6*d* the End, wherein was gained £15 *per Cent.* and ſeeing no other Chapman had ſo good, raiſeth them at the latter end of the Fair to 12*s*. I demand what he gained *per Cent.* by this laſt Sale?

s d £ *s* £ £

As 11 6 : 115 :: 12 : 120, from which deduct 100 and the remainder will be £20 the Anſwer, which in Mr. *Hill*'s Arith. is only £15.652 &c. = £15 13*s* –*d* ½.

Queſtion 4. by Mr. *Dilworth.*

See the ſecond Edit. of his Arithmetic, *page* 73.

Suppoſe I ſell 500 Deals at 15*d per* piece and £9 *per Cent.* loſs. What do I loſe by the whole Quantity?

£

Firſt from 100

Take 9

£ £ *s*

Then As 91 : 100 : 31 5 (the price of the Deals at 15*d* a piece): £34 6*s* 9*d* ¾, from which deduct £31 5*s*, and there will remain £3 1*s* 9*d* ¼ the Anſwer, which in Mr. *Dilworth*'s Arithmetic is only £2 16*s* 3*d*.

Queſtion 5. by Mr. *Walkingham.*

See the third Edition of his Arithmetic, *page* 70.

Snppoſe I ſell 1 *Cwt.* of Hops for £6 15*s* and gain £25 *per Cent.* What would have been the gain *per Cent.* if I had ſold them for £8 *per Cwt?*

£ *s* £ £ £ *s d*

As 6 15 : 125 :: 8 : 148 2 11 ½, from which deduct £100 and there will remain £48 2*s* 11*d* ½ the Anſwer, which in Mr. *Walkingham*'s Arith. is only £29 12*s* 7*d*.

EXCHANGE.

EXCHANGE conſiſts in finding fair,
What quantities of Monies are
In diff'rent places equal, and
The ſame—as you will underſtand.
To work *Exchange* conſpicuouſly,
Uſe *Practice*, or, the *Rule of Three*.

The *Courſe* of *Exchange* between any two kingdoms, riſes and falls upon different occaſions; *i. e.* is ſometimes above and ſometimes below the *Par*.

The *Par* of Exchange is always fixed, it being the intrinſic value of any *foreign* money compared with *Sterling*.

Money in the Bank of other kingdoms, is finer, or purer than that which is current, the difference of value in each is called *Agio*.

As there would be no end in treating of every kind of *Exchange*, in all *Countries*, I ſhall only treat of the *Exchange* of *England*, with a few of the chiefeſt Countries in *Europe*, &c.

First. *With IRELAND, AMERICA, and the WEST-INDIES.*

In theſe Countries their accounts are kept in Pounds Shillings and Pence the ſame as in *England*.—The *Par* of Exchange between *England* and *Ireland* is £100 *Sterling* for £108 6*s* 8*d Iriſh*, *viz.* 1*s Engliſh* for 13*d Iriſh*.—The *Courſe* of Exchange is from 5 to 12 *per Cent.* according to the balance in trade.

In *America* their Money is called *Currency*. In the *Weſt-Indies* £5 *Sterling* is worth 7 of the *Currency*, owing to the great plenty of foreign coins circulating there; but on the *Continent* of *America*, caſh is ſo ſcarce that they are obliged to ſubſtitute *Paper Currency* to carry on trade, which being ſubject to caſualties, ſuffer a great diſcount in the purchaſing of Bills of Exchange.

EXAM-

EXAMPLE 1.

London remits to *Dublin* £1460 10*s Sterling*. What muſt be receiv'd there, Exchange at £110 ½ *per Cent?*

£	£	s	d		£	
10 | 1/10	1460	10	–		100	
½ | 1/20	146	1	–	the value at	10	*per Cent.*
	7	6	– ½ ⅖		½	
Anſwer	1613	17	– ½ ⅖		110 ½	

£ £ £ s £ s d

Or, As 100 : 110 ½ : 1460 10 = 1613 17 – ½ ⅖ the Anſwer as above.

EXAMPLE 2.

Dublin remits to *London* £1613 17*s* –*d* ½ ⅖. What muſt be receiv'd there, Exchange at £110 ½ *per Cent?*

£ s £ £ s d £ s

As 110 10 : 100 :: 1613 17 – ½ ⅖ : 1460 10 the Anſ.

EXAMPLE 3.

Admit any part of the *Weſt-Indies* is indebted to *London* in £4168 16 10 ½ *Currency*. What *Sterling* muſt be receiv'd for the ſame, the Exchange being £150 *per Cent?*

£ £ £ s d £ s d

As 150 : 100 :: 4168 16 10 ½ : 2779 4 7 the Anſwer.

But *Note*, the work of the *Rule of Three* may often be much abbreviated by placing the firſt and ſecond terms, or the firſt and third terms of the ſtating, as a vulgar fraction, making the firſt term the denominator of ſuch fraction, and reducing it to its loweſt terms,

for the value of that fractional part of the other term will be the anſwer, thus: the firſt and ſecond terms in the preceding ſtating placed as a fraction become $\frac{100}{150} = \frac{2}{3}$ in its loweſt terms, then $\frac{2}{3}$ of the other term £4168 16*s* 10*d* $\frac{1}{2}$ will (by *Caſe* 12 in Vulgar Fractions, *page* 255, or by *Article* 2, *page* 274,) be eaſily found to be £2779 4*s* 7*d*, the ſame as in the preceding *page*.

EXAMPLE 4.

Suppoſe *London* receives a bill of Exchange from any part of the *Weſt-Indies* for £2779 4*s* 7*d Sterling*. For how much *Currency* was *London* indebted, Exchange being at 50 *per Cent?*

£		£	*s*	*d*		£	
50	½	2779	4	7	the value at	100	per Cent.
		1389	12	3½		50	
Anſ.		£4168	16	10½		150	

Second, *With* HOLLAND, FLANDERS, *and* GERMANY.

In theſe Countries their accounts are kept in Pounds, Shillings and Pence, as in *England*, and ſometimes in Guilders, Stivers and Pennings.——In *Holland* and *Flanders* the Money is diſtinguiſhed by the name of *Flemiſh*; Exchange being made with *London* from 30*s* to 38*s Flemiſh per* Pound *Sterling*.

NOTE.

8 Pennings	make one	Groat	20 Stivers	make one	Flor. or Guild.
2 Groats		Stiver	2½ Florins		Rix Dollar
6 Stivers		Shilling	6 Florins		Pound *Flemiſh*
			5 Guilders		Ducat

EXAM-

EXAMPLE 1.

How much *Flemiſh* will £840 *Sterling*, amount to Exchange being at *Par*, *viz.* 33*s* 4*d* *Flemiſh per* Pound *Sterling*?

£ £ *s d* £ £

As 1 : 1 13 4 :: 840 : 1400 the Anſwer.

Or, by the *Note* in *page* 387.——The pence in a pound *Sterling*, and 33*s* 4*d* placed as a fraction and reduced to its loweſt terms become $\frac{5}{3} = 1\frac{2}{3}$ therefore to £840 add the $\frac{2}{3}$ of itſelf and the ſum will be £1400 the ſame as above.

EXAMPLE 2.

How much *Sterling* will £1400 *Flemiſh* amount to, Exchange at 33*s* 4*d per* pound *Sterling*?

£ *s d* £ £ £

As 1 13 4 : 1 :: 1400 : 840 the Anſwer.

Or $\frac{240}{400} = \frac{3}{5}$, and $\frac{3}{5}$ of £1400 = £840 as above.

COROLLARY.

When *Flemiſh* Pounds Shillings and Pence are to be reduced to Guilders.—Divide the whole Sum when reduced into Pence *Flemiſh* by 40 (the number of Pence in one Guilder) and the quote will be Guilders, the remainder (if any) will be Pence, which divide by 2 (the Pence in one Stiver) and the quotient will be Stivers.

EXAMPLE 3.

In £846 16*s* *Flemiſh*, how many Guilders?

£ *s*

864 16

20

17296

12

40)207552

Guil. Stiv.

Anſwer 5188 $\frac{12}{40}$ *Guilders* = 5188 16

Example 4.

In 5188 *Guil.* 16 *St.* How many *Flemiſh* Pounds?

Guil.	*St.*	
5188	16	= 32*d.*
	40	
12)207552		
2|0)17296		
£864	16*s*	Anſ.

Corollary 2.

When you are to change *Current* money into *Banco*, and *Banco* into *Current*, they muſt be proportioned thus, As 100 with the *Agio* added to it, is to 100 *Banco*, ſo is any given ſum *Current* to its value in *Banco*. And as 100 is to 100 with the *Agio* added to it, ſo is the *Banco* given to its value *Current*.

☞ *Bank* money being worth more than *Current*, the difference is called *Agio*, and is from 3 to 6 *per Cent.* in the *Bank*'s favour.

Example 5.

Change 110 Guilders 12 Stivers *Current*, into *Banco* Florins, *Agio* 4 *per Cent.*

Guil. Guil. Guil. St. Guil. St. Gr. Pen.

As 104 : 100 :: 110 12 : 106 6 1 6 the Anſ.

Example 6.

Change 340 Guilders 12 Stivers *Banco* into *Current*, *Agio* $4\frac{5}{8}$ *per Cent.*

Guil. Guil. St. Gr. Guil. St. Guil. St.

As 100 : 104 12 1 :: 340 12 : 356 7 Anſwer.

Third, *With FRANCE.*

At *France* accounts are kept in Livres Sols and Deniers, Exchange being made by the *French* Crown, whoſe *Par* is 4*s* 6*d Sterling*.

Note. Twelve Deniers make 1 Sol, or Sou; 20 Sols 1 Livre, and 3 Livres 1 Crown, or Ecu.

Exam-

Example 1.

What *Sterling* money muſt a Merchant pay in *London* to receive in *Paris* 4000 Crowns, Exchange at 54*d per* Crown, or Ecu?

C d C £

As 1 : 54 :: 4000 : 900 the Anſwer.

Example 2.

What number of Crowns muſt be paid at *Paris* to receive in *London* £900, Exchange 54*d per* Crown?

d C £ C

As 54 : 1 :: 900 : 4000 the Anſwer.

Example 3.

What will 140 Livres, 6 Sols, 8 Deniers amount to in *London*, at 56*d per* Crown or Ecu at *Paris*?

Cr. d Liv. ſol den. £ s d

As 1 : 56 :: 140 6 8 : 10 18 3 $\frac{1}{9}$ the Anſwer.

Example 4.

To how much *French* money will £10 18*s* 3*d* $\frac{1}{2}$ *Sterling* amount, Exchange at 56*d per* Crown?

d C £ s d Liv. ſol den

As 56 : 1 :: 10 18 3 $\frac{1}{2}$: 140 6 8 nearly Anſwer.

Fourth, *With SPAIN.*

In this Kingdom they keep their accounts in Piaſtres, Reals and Marvadies, and Exchange by the Piaſtre, whoſe *Par* is 4*s* 6*d Sterling*.

Note. 372 Marvadies make 1 Rial, and 8 Rials 1 Piaſtre.

Exam-

Example 1.

For ſix hundred Guineas of good *Britiſh* gold,
How many Piaſtres I pray let be told,
Exchange fifty pence, *per* Piaſtre, not more,
All this with much eaſe you may quickly explore?

d Pi. Guin. Pi.

As 50 : 1 :: 600 : 3024 the Anſwer.

Example 2.

Suppoſe *Spain* draws upon *London* for 3024 Piaſtres: What *Sterling* money will this draught amount to, when the Exchange is 50*d per* Piaſtre?

Pi. d Pi. £

As 1 : 50 :: 3024 : 630 the Anſwer.

Example 3.

Change £4000 10*s* 4$d\frac{3}{4}$ *Sterling* into *Spaniſh* money, Exchange at 54$d\frac{1}{4}$ *per* Piece of Eight?

d P. £ s d Pieces

As 54$\frac{1}{4}$: 1 :: 4000 10 4$\frac{3}{4}$: 17698$\frac{33}{217}$ Anſwer.

Example 4.

Admit *Bilboa*, or any part of *Spain* remits to *London* 160 Piaſtres, 3 Rials, 8 Marvadies, Exchange at 51$d\frac{1}{2}$ *per* Piaſtre: What will this remittance amount to in *Sterling* money?

P. d P. rials. £ s d

As 1 : 51$\frac{1}{2}$ :: 160 3 8 : 34 8 3$\frac{3}{4}\frac{29}{372}$ the Anſwer.

Fifth, *With PORTUGAL.*

Accounts are kept in *Portugal* in Milreas and Reas, and they Exchange by the Milrea, whoſe *Par* is about 6*s* 8$d\frac{1}{2}$ or 6*s* 9*d Sterling*.

Note. 400 Reas make 1 Cruſadoe, and 1000 Reas, 1 Milrea.

Exam-

EXAMPLE I.

A Merchant at *Liſbon* remits to his Correſpondent in *London* 1000 Milreas. How much *Sterling* muſt he receive, Exchange at 5*s* 6*d per* Milrea?

s		£		£ *s d*	
5	$\frac{1}{4}$	1000		1 — —	
d					
6	$\frac{3}{10}$	250		— 5 —	
		25		— — 6	
Anſwer		£275	the value in *Sterling* money at	— 5 6	*per* Milrea.

EXAMPLE 2.

To how much *Sterling* will 190 Milreas 604 Reas amount, Exchange at 70*d* $\frac{1}{4}$ *per* Milrea?

Mil. d Mil. Reas £ s d

As 1 : 70 $\frac{1}{4}$ :: 190 604 : 55 15 9 $\frac{3}{4}$ $\frac{181}{250}$ the Anſ.

EXAMPLE 3.

How many Milreas will £55 15*s* 9*d* $\frac{3}{4}$ $\frac{181}{250}$ amount to, Exchange at 70*d* $\frac{1}{4}$ *per* Milrea?

d M. £ s d Mil. Reas

As 70 $\frac{1}{4}$: 1 : 55 15 9 $\frac{3}{4}$ $\frac{181}{250}$: 190 604 the Anſwer.

SCHOLIUM.

When ſeveral weights or meaſures of different countries are compared together, and it is required to find how many of the one are equal to a given quantity of the other.—Firſt place the numbers alternately under each other in two ſtraight columns, in ſuch manner that no two terms of one kind may be found in one and the ſame column, then multiply the numbers together in the leaſt column for a diviſor, and the numbers in the other column (where the odd term is) for a dividend, and the quotient will be the anſwer.—The work may often be abridged by rejecting numbers that are alike in both columns.

EXAM-

Example 1.

If 1 Cwt. of goods at *London*, are equal to 124 ℔ at *Paris*, and 112 ℔ at *Paris* are equal to 100 ℔ at *Liſbon*. How many pounds at *London* are equal to 140 ℔ at *Liſbon?*

	℔			℔	
Firſt	112	} at {	*London*	124	} at { *Paris*
	112		*Paris*	100	*Liſbon*
	140		*Liſbon*		

Then per Scholium. 112×112×140=1756160 the Dividend, and 124×100=12400 the Diviſor, by which divide 1756160 and the quotient will be 141 ℔ $\frac{97}{155}$ the Anſwer.

Example 2.

If 100 ℔ at *Copenhagen* be equal to 80 ℔ at *Rome*, and 100 ℔ at *Rome* be equal to 114 ℔ at *Madrid*.— How many pounds at *Madrid* are equal to 180 ℔ at *Copenhagen?*

	℔			℔	
Firſt	100	} at {	*Copenhagen*	80	} at { *Rome*
	100		*Rome*	114	*Madrid*
				180	*Copenhagen*

Then per Scholium in the preceding *page*. 80×114×180=1641600 the Dividend, and 100×100=10000 the Diviſor, by which divide 1641600 and the quotient will be 164*lb*. $\frac{4}{25}$ the Anſwer.

Promiscuous Questions.

Queſtion 1. by Mr. *John Ward.*

See his Mathematicians Guide, *page* 108. 5th Edit.

Suppoſe I would Exchange £527 17*s* 6*d* for Dollars at 4*s* 6*d* a piece, Ducats at 5*s* 8*d* a piece, and Crowns at

at 6*s* 1*d* a piece, and would have 2 Dollars for 1 Ducat, and 3 Dollars for 2 Crowns. How many of each ſort muſt I have?

Firſt 54*d* = 1 Dollar, 68*d* = 1 Ducat, 73*d* = 1 Crown and 126690*d* = £527 17*s* 6*d*. *Then*, as (*per* Queſtion) there muſt be

$$\left.\begin{matrix}2\\ \text{and } 3\end{matrix}\right\} \text{ Dollars for } \left\{\begin{matrix}1 \text{ Ducat}\\ 2 \text{ Crowns}\end{matrix}\right.$$

conſequently it will be but

$$\left.\begin{matrix}\frac{1}{2}\\ \text{and } \frac{2}{3}\end{matrix}\right\} \text{ of a } \left\{\begin{matrix}\text{Ducat}\\ \text{Crown}\end{matrix}\right\} \text{ for 1 Dollar}$$

therefore $54 + \frac{68}{2} + \frac{2 \times 73}{3} = 136\frac{2}{3}$ the Diviſor, by which divide 126690*d* (ſee *Diviſion of Vulgar Fractions*) and the quotient will be

$$\left.\begin{matrix}927\\ \text{and } \frac{1}{2}\\ \text{and } \frac{2}{3}\end{matrix}\right\} \text{ of which is } \left\{\begin{matrix}927\\ 463\frac{1}{2}\\ 618\end{matrix}\right\} \text{ the No. of } \left\{\begin{matrix}\text{Dollars}\\ \text{Ducats}\\ \text{Crowns}\end{matrix}\right\} \text{ requir'd.}$$

Queſtion 2 by Mr. *Malcolm*.

If I receive 11 Crowns an 7 Dollars for £4 10*s* 10*d*, or 4 Crowns and 3 Dollars for £1 15*s* the value of 1 Crown and 1 Dollar being the ſame in both. What is that Value?

	£	*s*	*d*		*d*
Firſt	4	10	10	=	1090
and	1	15	0	=	420

	d		*Cr.*		*Do.*				*d*		*Cr.*		*Do.*
Then	1090	=	11	+	7	mult by	3	produce	3270	=	33	+	21
and	420	=	4	+	3		7		2940	=	28	+	21

Rems. *d*330 = 5 Cr.

and conſequently the $\frac{1}{5}$ of 330*d* = 5*s* 6*d* muſt be the value of a Crown, and as 4 Crowns and 3 Dollars are equal to 35*s*, therefore, from that ſum deduct 22*s* the value of 4 Crowns, and the remainder will be 13*s* the value of 3 Dollars, whence 4*s* 4*d* (the $\frac{1}{3}$ of 13*s*) muſt be the value of a Dollar.

ALLI-

ALLIGATION.

BY *Alligation* you may find,
When ſev'ral ſimples are combin'd;
Or mix'd together ſo to be,
Juſt of a middle quality.

CASE I.

When you are to reſolve a Queſtion in ALLIGATION MEDIAL *which teaches how to find the* mean rate *of a mixture, when each* particular quantity *and* their ſeveral rates *are given, obſerve the following*

RULE.

Take care at firſt to multiply
The quantities o'th' mixture by
Their price reſpective, and divide
The ſum o'th' products next, (beſide)
By th' ſum o'th' quantities you'll ſee
The quotient the mean rate will be.

EXAMPLE I.

Admit a Farmer would mix 20 Buſhels of Wheat at 6*s* 8*d per* Buſhel, with 36 Buſhels of Rye at 4*s* 4*d per* Buſhel. What would a Buſhel of this Mixture be worth?

		s *d*		*l.* *s* *d*	
20	×	6 8	=	6 13 4	the value of 20 Buſh. of Wheat
36		4 4		7 16 –	36 Buſh. of Rye
Sum 56				14 9 4	the whole
56				2 1 4	8 Buſhels of the Mixture.
			Anſwer	5*s* 2*d*	1 Buſhel of the Mixture.

EXAM-

EXAMPLE 2.

Fat *Toby* well known for a merry old blade,
When cracking his jeſts at his ſuddling trade,
Mix'd a caſk of four diff'rent ſorts of ſtrong beer,
Whoſe prices will quickly be made to appear;
Twelve gallons at ſixteen pence * firſt he drew out, * *per gal.*
Next nine gallons more of the beer he call'd *Stout*,
Which was charg'd at two ſhillings *per* gallon not leſs,
The value of which you may eaſily gueſs. *d*
Next ten gallons more at the rate † here ſubjoin'd, † 18 *d* *per gal.*
And ſix of the liquor which pleaſed his mind, 20
Whoſe rate in the margin § you alſo may find. § *per gal.*
Now how much *per* gallon muſt th' liquor be ſold
To *John*, *Ralph* or *Simon*, be pleas'd to unfold?

		d		*d*			
12		16		192		12	
9	×	24	=	216	the value of	9	Gallons
10		18		180		10	
6		20		120		6	
Sum 37			37)	708		whole	Mixture.
		Anſwer *d* 19 5/37				1 Gal. of the	

CASE 2.

When you are to reſolve a Queſtion in ALLIGATION ALTERNATE, (*which is the reverſe of* Alligation Medial *and conſequently may be proved thereby*) *obſerve the following*

RULE.

The rates o'th ſimples, fair to ſight,
In a column under each *one* write;
And the mean rate before let ſtand
Juſt oppoſite on the left hand.

The ſev'ral rates muſt linked be,
One greater than the *mean* you ſee
To *one* or any numb'r of leſs,
Or otherwiſe, juſt the reverſe;
One leſs than the *compound one*, you
Link to a greater,—*Tyro*, true,
Or any number in your view.
To take the diff'rence now prepare,
O'th' mean and rates whate'er they are,
Which oppoſite the rates you find,
Are link'd, or varioully combin'd.

} of greater rates

Note. It is plain from the abovementioned rule (as well as from an *algebraic* proceſs from whence the Rule is derived) that all Queſtions of this Caſe are indeterminate and admit of various Anſwers, except ſuch Queſtions that have but one Rate each, either greater or leſs than the mean, for ſuch a Queſtion will only admit of one way of linking, and conſequently (by the *Rule*) will have but one Anſwer, tho' all Numbers that bear the ſame proportion between themſelves as thoſe that compoſe the Anſwer will alſo ſatisfy the condition of the Queſtion, ſo that after one or more Anſwers are obtained by the Rule, you may find as many more as you pleaſe by increaſing or decreaſing the quantities in any proportion; or by only increaſing or decreaſing the quantities of any one or more *ſingle* pairs of yoke-fellows in any proportion, and leaving the others as they are.

EXAMPLE I.

A Grocer wou'd mix Sugar at 11*d*, 6*d* and 5*d per* pound, ſo that the Compoſition may be worth 7*d per* pound. What quantity of each muſt he take?

d		*lb*		*d*	
11	2, 1	3		11	2
7 { 6	4	4	at	6	2
5	4	4		5	2

Having firſt linked the ſeveral Rates agreeable to the Rule in

in the preceding *page*, (whereby it is plain that theſe Rates will admit but of this one way of linking) then the difference between 5 and 7 *viz.* 2 is placed againſt 11 its yoke-fellow, the difference between 6 and 7 is 1 which is alſo placed againſt 11 its yoke-fellow, and the difference between 7 and 11 is 4 which, becauſe it has two yoke-fellows is placed againſt them both *viz.* againſt 6 and 5, ſo that as oft as the Grocer takes 3 lb at 11*d* a pound, he muſt take 4lb of each of the other two ſorts to make up the Mixture.

EXAMPLE 2.

Old *Merry* the Miller, won'd mix as we find,
What Corn you obſerve in the margin * ſubjoin'd.
How much of each ſort will exactly agree
To be ſold at five ſhillings *per* buſhel tell me?

		s	*d*		*d*	
Wheat		6	8		80	
Rye	at	5	6	=	66	*per* Buſhel
Beans		4	4		52	
Barley		3	8		44	

d		*d*			
60	Wheat	80 —	16	Buſhels of	Wheat
	Rye	66	8		Rye
	Beans	52	6		Beans
	Barley	44 —	20		Barley

The ſeveral Rates being linked together, then the difference between 44 and 60 *viz.* 16, is placed againſt 80 its yoke-fellow, the difference between 52 and 60 which is 8, is placed againſt 66 its yoke-fellow, the difference between 60 and 66 is 6, which is placed againſt 52 its yoke-fellow, and the difference between 60 and 80 is 20, which is placed againſt 44 its yoke-fellow, ſo that 16 Buſhels of Wheat, 8 of Rye, 6 of Beans, and 20 of Barley at the reſpective prices above-mentioned will compoſe the Mixture required. *Or*, if

you were desirous to make up a less Mixture than the above, as suppose a quarter part, then divide the several differences or quantities by 4 and the Answer will be 4 Bushels of Wheat, 2 of Rye, 1 $\frac{1}{2}$ of Beans, and 5 of Barley, which numbers being in the same proportion between themselves as the abovementioned differences are, will therefore compose the required Mixture.

d		*d*			
60	Wheat	80	8		*OR*, if 80 and 52 be linked together, and 66 and 44, and the differences placed respectively, the Answer (you see) will be 8 Bushels of Wheat, 16 of Rye, 20 of Beans and 6 of Barley. *Or*, suppose you wou'd have twice as much Wheat in the Mixture as this way of linking the Rates produces, and but $\frac{1}{3}$ part of the Rye, then (according to the *Note* in *page* 398) double the quantity of Beans as well as the Wheat (their prices being yoke-fellows) and also take as well $\frac{1}{3}$ part of the Barley as the Rye (they being yoke-fellows) and the Answer will be 16 Bushels of Wheat, 2 of Rye, 40 of Beans and 3 Pecks of Barley.
	Rye	66	16		
	Beans	52	20		
	Barley	44	6		

		d			
d					
60	Wheat	80	16,8	24	*AGAIN*, if 80 be linked both with 52 and 44, and 66 with 44, and the differences placed respectively, the Answer (you see) will then be 24 Bushels of Wheat, 16 of Rye, 20 of Beans and 26 of Barley.
	Rye	66	16	16	
	Beans	52	20	20	
	Barley	44	6,20	26	

		d			
d					
60	Wheat	80	16, 8	24	*ALSO*, if 80 be linked both with 52 and 44, and 66 both with 52 and 44 and the differences placed respectively (remembering that if any Rate have two yoke-fellows it will have two differences)
	Rye	66	16, 8	24	
	Beans	52	6, 20	26	
	Barley	44	6, 20	26	

differences) the Answer (by this way of linking) will be 24 bushels of Wheat, 24 of Rye, 26 of Beans and 26 of Barley, and that all these different Answers will compose the Mixture required is easily proved by *Case* 1 of this Rule, and thus you see innumerable Answers to any Question of this kind may be easily obtained.——There are other ways of linking the Rates of this Example, but these already given are quite sufficient to shew the method, and as I have been so copious in explaining this Example, I shall therefore in each of the following *ones* in this Rule that will admit of being variously linked, shew but one way and consequently obtain but one Answer thereto.

CASE 3.

When you are to resolve a Question in Alligation Partial, *viz. where* one of the quantities *to be mixed is given, observe the following* RULE.

As th' difference that's standing fair,
Against the price o'th' given ware
Or quantity, whate'er it be,
Is to the given quantity;
So are the other diff'rences,
To the respective quantities.

EXAMPLE 1.

Admit a Miller wou'd mix 20 Bushels of Wheat at 5*s* 6*d per* Bushel, with Rye at 4*s* and Barley at 3*s*, and would sell the same out again at 4*s* 6*d per* Bushel.—How much Rye and Barley must he take?

		d		
d	Wheat	66	18,6	24
54	Rye	48	12	12
	Barley	36	12	12

As 24 : 20 :: | 12 | : | 10 | Bush. of | Rye | to be mix'd with
| 12 | : | 10 | | Barley | the 20 of Wheat.

Note. All Examples that belong to *this* and the following *Case* may be easily proved by the Rule in *page* 396, *viz. Alligation Medial.*

Example 2.

What quantity of Gold at 15, 16 and 18 Caracts fine, must be mixed with 80 *oz.* of pure Gold *viz.* such as is 24 Caracts fine, so that the Composition may be 20 Caracts fine?

20	24	4,5,2	11 *oz.*
	18	4	4 *oz.* *oz.* *oz.* *oz.*
	15	4	4 As 11 : 80 :: 4 : 29 $\frac{1}{11}$ of 15, 16,
	16	4	4 and 18 Caracts fine, Answer.

Case 4.

When you are to resolve a Question in Alligation Total, i. e. *when the* Total Sum of the Quantities *to be mixt is given, observe the following*

Rule.

As th' sum of th' differences say,
To th' given quantities alway,
So every diff'rence will be,
To its respective quantity.

Example 1.

Suppose a Grocer would mix 3 sorts of Sugar at 6*d*, 8*d* and 10*d per* ℔ to have a quantity of 1 Cwt. and would sell it out at 7*d per* ℔. How much of each sort must he take?

	d		℔		℔	℔		*d*
d	10	1	1	℔ ℔	1	18 $\frac{2}{3}$	the Qty. at	10
7	8	1	1	As 6 : 112 ::	1	18 $\frac{2}{3}$		8
	6	1,3	4		4	74 $\frac{2}{3}$		6
		Sum	6			112	wh. Qty.	
			lb. *d*					*lb. d*

Proof. As 112 : 784 the value of the Mixture :: 1 : 7 the mean price given.

Note. It is very obvious from the *Rule* in *page* 397 that the rates in *this* and the two next *preceding Examples* will admit of being linked in no other manner than as they are.

Exam-

EXAMPLE 2.

Suppoſe I was to mix up a caniſter of Tea to contain 30 lb of 5 different prices, *viz.* of 4*s*, 5*s*, 7*s* 9*d* and 10*s per* lb, ſo as to make the Mixture worth 8*s per* lb. How much of each ſort muſt I take?

		lb			lb	lb
10	4	4		4	10	
9	3.1	4	lb. lb.	4	10	
7	1	1	As 12 : 30 ::	1	$2\frac{1}{2}$	
5	1	1		1	$2\frac{1}{2}$	
4	2	2		2	5	
Sum	12				30	

PROMISCUOUS QUESTIONS.

Queſtion 1. by Mr. *James Hardy*.

A Hogſhead of Wine that coſt 15 Guineas was lowered with Water, ſo that the Mixture at 4*s* 6*d per* Gallon would juſt fetch the price of the Hogſhead. What quantity of Water was added?

s d. Gal. £ s

As 4 6 : 1 :: 15 15 : 70 Gallons, from which deduct 63 (the number of Gallons in a Hogſhead) and there will remain 7 Gallons, the quantity of Water that was added.

Queſtion 2 by Mr. *Edward Cocker*.

A Goldſmith hath Gold of 4 ſeveral ſorts of fineneſs, *viz.* of 24 Carats fine, and of 22 Carats fine, of 20 Carats fine, and of 15 Carats fine, and he would mingle ſo much of each with Alloy, that the whole Maſs of 28 Ounces of Gold ſo mingled may bear

bear 17 Carats fine. I demand how much of each he muſt take?

						oz.	oz.		
24	17	17			17	13		24	Car. fine.
22	2	2			2	1		22	
17 20	2	2	oz oz		2	1	the quantity of	20	
15	3,5	8	As 36 : 28 ::		8	6		15	
0	7	7			7	5		Alloy	
								wh.qty.	
	Sum	36				28			

Note. In Mixtures it ſometimes happens (as above) that one ingredient bears no value but is uſed only to increaſe the quantity or diminiſh its worth, and therefore muſt be repreſented by a cypher, as Water mix'd with Wine, Copper or other Alloy with Gold or Silver.

ARITHMETICAL PROGRESSION.

THIS *Rule* directs you very fair,
When any ranks of numbers are
Increaſing or decreaſing by
A common diff'rence low or high.

A *Series of Progreſſionals* (or as ſome call 'em *Arithmetical Proportionals*) is a rank of numbers (above two) that follow each other increaſing or decreaſing regularly by a *Common Difference*.

Hence

1, 2, 3, 4, 5, 6	is a Rank or Series of Progreſſionals	increaſing	by the Common Difference	1
6, 5, 4, 3, 2, 1		decreaſing		1
1, 3, 5, 7, 9, 11		increaſing		2
and				
30, 25, 20, 15, 10, 5		decreaſing		5

The

The *Numbers* that compoſe a *Rank* or *Series* of *Progreſſionals* are called its *Terms*, whereof the *firſt* and *laſt* are called *Extremes*, and any two equally diſtant from them *Means*.——Now when the Number of the Terms is even, the *Sum* of the *Extremes* is *equal* to the *Sum* of *any two Means* that are at equal diſtance from ſuch *Extremes* thus, in the Series 3, 4, 5, 6. *the Sum of the Extremes* 3 and 6, is equal to *the Sum of the Means* 4 and 5.——And if the Number of Terms in the *Series* be odd, *twice the middle Term* or *Mean* is always equal to *the Sum of the Extremes*, ſo in this Series 4, 10, 16, 22, 28, *the double of the Mean* 16, is *equal* to *the Sum of the Extremes* 4 and 28.

There are 5 things to be obſerved in *Arithmetical Progreſſion*, viz.

1. The { first / laſt } Term commonly the { leaſt / greateſt }
2.
3. The Number of Terms
4. The Common Exceſs or Difference
5. The Aggregate or Sum of all the Terms

Any three of theſe being given the other two may be eaſily found.

PROPOSITION I.

When the firſt Term, Number of Terms *and* Common Exceſs *are given to find the* laſt term.

RULE.

The Common difference ſubtract
From th' number of Terms (to be exact)
When multipli'd by th' common exceſs,
Let it be more, or be it leſs,
Th' remainder added to th' firſt Term,
Will give the laſt I can affirm.

Or, Multiply the Number of Terms *minus* Unity by the Common Exceſs, to the Product add the firſt Term, and the Sum will be the laſt Term.

EXAM-

EXAMPLE.

What is the last Term of an *Arithmetical Progression* or *Series* beginning at 4 and continuing by the increase of 2 to 60 places?

First $60 \times 2 = 120$, and $120 - 2 = 118$ *Then* $118 + 4 = 122$ the last Term required.

PROPOSITION 2.

When the first *and* last Terms (*viz.* the two Extremes) *and* Number of Terms *are given to find the* Sum of all the Terms or Series.

RULE.

The Sum o'th' Extremes multiply
Into half the Number of Terms that's by
And th' answer quickly you'll descry

EXAMPLE 1.

How many Strokes does the Hammer of a Clock strike in 12 Hours?

$1 + 12 = 13$ the Sum of the Extremes
6 half the Number of Terms

Answer 78 Strokes.

Or,

$$\frac{1+12}{2} = 6.5 \qquad 1 + 12 = 13$$

$$\begin{array}{r} 12 \\ \hline 78 \text{ Ans.} \end{array} \qquad \begin{array}{r} 12 \\ \hline 2)156 \\ \hline 78 \text{ Ans.} \end{array}$$

EXAMPLE 2.

Near *Newhall* mill was lately made
A wager by a *Taylor*, One

One hundred Stones to gather up,
As told me by a *Sailor.*
To do the feat he was allow'd
In minutes *Forty-five*,
Just *Johnny Wilkes*'s number fair,
'Tis true as I'm alive.
Right in a line the Stones were plac'd 1812
Exact a yard asunder,
How many miles then did he run,
To gather up that number? *
And tell me *Tyro* if you please,
From what is here subjoin'd †
Exact the time the *Taylor* run
To please his anx'ous mind

It's very plain from the Question that twice the Sum of the Series whose first Term and Common Difference are 1, and number of Terms 100 will be the Distance required, therefore

Yds. Miles Yds.

$1+100\times100=10100=5\frac{1}{4}$ wanting 20 } the { Dist. } ran.

Yds F. Min. Yds. Minutes

And *then* As $252\ 1\frac{1}{4}:1::10100:40\frac{40}{3029}$ } the { Time } ran.

PROPOSITION 3.

When the first Term, Number of Terms *and* Common Excess *are given to find the* Sum of all the Terms *or* Series.

RULE.

Th' Number of Terms by th' common Excess
Multiply,——and th' Product make less
By th' common Difference, and to
What's left, add twice th' first Term also.
Then half of that Sum multiply
By th' Number of Terms and you'll espy
The Sum of all,——the Series true,
As underneath I'll quickly shew.

---

* *i. e.* To gather them singly and put them into a Basket. † 252 Yds. 1 Ft. 3 Inches *per* Minute.

EXAM-

EXAMPLE.

Suppoſe I agree with a Pump-maker to ſink a Well 20 Yards deep and am to pay him 1*s* for the firſt Yard, 3*s* for the ſecond, 5*s* for the third, and ſo on raiſing 2*s* every Yard. What will the whole amount to?

The Number of Terms multipli'd by the common Difference produces 40, from which deduct 2 the common Difference or Exceſs, and the remainder will be 38, which add to twice the firſt Term *viz.* 2 and the ſum will be 40, half of which is 20, which multiplied by 20 the Number of Terms produce 400 Shillings = £20 the Anſwer.——*Or*, If you add the above-mentioned Remainder 38 to the firſt Term only, according to *Propoſition* 1, *page* 405, (and not to the double of the firſt Term) the Sum will be 39 the laſt Term, and then there will be given the firſt Term, laſt Term, and Number of Terms as in the preceding *Propoſition*, *page* 406, to find the Sum of the Series and therefore the Remainder 38 being added (as above) to twice the firſt Term gives the Sum of the Extremes and conſequently by any of the methods in the ſaid next *preceding Propoſition* the Anſwer will be eaſily found to be £20 as above.

Note. When the firſt Term and common Difference of any Arithmetical Series are each of them an Unit, then it is plain from the firſt mentioned Series in *page* 404, that the Number of Terms and laſt Term of ſuch Series will always be equal to each other, as in *Example* 1 *page* 406, for the firſt Term and common Difference being each an Unit, therefore the Number of Terms and laſt Term are both equal *viz* 12:—But if either the firſt Term or common Difference in any aſcending Arithmetical Series be more than an Unit, then the laſt Term thereof will always be greater than its Number of Terms as in the *Exam-*

ple in this *Propoſition* the number of terms is 20 but as the common difference is greater than an Unit *viz.* 2, therefore 39 is the laſt term as is eaſily found by *Propoſition* 1 in *page* 405.

PROPOSITION 4.

When the firſt *and* laſt Terms *viz. the* two Extremes, *and* Number of Terms *are given to find the* Common Difference *or* Exceſs.

RULE.

The Diff'rence of the two extremes,
Divide by the number of Terms
Leſs one—and the Quotient will be,
The common Diff'rence you will ſee.

EXAMPLE.

A *Cooper* who loved to ſmoke and to drink,
A Debt had to pay but was ſhort of the *chink*,
In Arithmetical Progreſſion agreed for to pay
The Sum at twelve diff'rent payments they ſay,
Th' firſt payment two Shillings the laſt juſt a ſcore,
The whole Debt young *Tyro* with eaſe you'll explore
And what was the Sum of each payment agreed
By the *Cooper* to pay?—Come tell me with ſpeed.

From 20 the greater Extreme take 2 the leſs Extreme and the remainder will be 18 which divide by 11 *viz.* the number of Terms leſs 1, and the Quotient will be $1s\ 1\frac{7}{11} = 1s\ 7d\ \frac{1}{2}\ \frac{6}{11}$ the common Exceſs or Increaſe, which add to each payment and the whole Debt will be found to be £6 12*s* as is alſo plain from either of the two *Propoſitions* in *pages* 406 and 407.

PROPOSITION 5.

When the firſt *and* laſt Terms *viz. the* two Extremes *and* Common Exceſs *are given to find the* Number of Terms.

RULE.

The Diff'rence o' th' Extremes divide
By th' common Exceſs, to th' Quote beſide
Add Unity,—the Sum will be
Th' number of Terms as you will ſee.

EXAMPLE.

Admit a Man was to go a journey and his firſt day's travel to be 6 Miles and the laſt 60, every day encreaſing his journey by 4 Miles. Howmany days would he be in compleating the ſame.

Firſt 60—6=54 the Difference of the Extremes *Then* divide 54 by 4 the Common Exceſs, and the Quotient will be $13\frac{1}{2}$, to which add 1 and the Sum will be $14\frac{1}{2}$ days the Anſwer.

PROPOSITION 6.

When the laſt Term, Number of Terms *and* Common Exceſs *are given to find the* firſt Term.

RULE.

Th' common Exceſs firſt multiply
By the number of terms leſs unity,
The product from th' laſt Term ſubtract,
And the Reſult's the firſt in fact.

EXAMPLE.

A Gentleman to beſtow his Charity takes out of his Pocket a certain number of halfpence which he gives to 12 poor perſons, every one receiving 3 more than the former. What had the firſt when the laſt receiv'd two Shillings and what was the Sum the Gentleman beſtow'd?

Firſt

Firſt The number of Terms leſs 1 *viz.* 11 multipli'd by 3 the common Exceſs produces 33 which deduct from 48 the halfpence in 2*s* and the remainder will be 15 halfpence $=7d\frac{1}{2}$ the ſum the firſt perſon receiv'd *Then* by *Propoſition* 2, *page* 406, or by *Propoſition* 3, *page* 407; it may be eaſily known that 15*s* 9*d.* was the whole ſum that the Gentleman gave away.

PROPOSITION 7.

When the Number of Terms, Common Exceſs *and* Sum of all the Series *are given to find the* firſt Term.

RULE.

The ſum of all the Terms divide
By th' number of Terms, and beſide
From the Quotient, ſubtract (not leſs
Than) half th' product of th' common Exceſs
Into th' number of Terms leſs Unity,
Th' remainder will the firſt Term be.

EXAMPLE

Humbly addreſs'd to all ingenious young Ladies.

Near *Nantwich* town now lives a charming *Fair*,
Thither ye blooming Maids in haſte repair,
There learn the force of Wit and Beauty's Charms,
And Virtue hourly guarding her from Harms,
There learn t' admire ſuperior Reaſon Senſe,
The pow'r of Wiſdom and of Eloquence!
All you can wiſh in this bright Maid combine,
To make her lovely and appear divine!
Well vers'd in figures is this charming Maid,
Minerva ſmiling gives her all her Aid,
Inſtructs the *Fair* as *Damon* well can prove,
Such heav'nly pow'rs make Man do more than love.

Ye brill'ant *Fair* who with this Maid can vie,
Learn from her precepts, imitate and try
To work th' Example which the *Swain* did poze,
The taſk is nothing to the faireſt Muſe.

QUESTION.

This amiable *fair One*, being in company with a very agreeable young Gentleman, told him that in $2\frac{1}{2}$ years ſhe ſhou'd receive the whole of her fortune, which was £1000. that next quarter's dayſhe ſhou'd receive the firſt payment and eachpayment afterwou'd exceed the former by £20. "Now Sir" (ſays ſhe, ſmiling on the young Gentleman) "I am free to give you the firſt payment, provided, you will tell me what it is from the given *Data*", but the young Gentleman being unſkill'd in numbers cou'd not comply to her propoſal, but leaves it to the ſtudy of the *fair-ſex* to reſolve the Queſtion, and tell him the firſt payment.

Firſt divide 1000 the Sum of the Series, by 10 the number of Terms *i e* the Quarters in $2\frac{1}{2}$ years and the Quotient will be 100. *Then* from 10 deduct 1 and the remainder will be 9 which multiplied by 20 the common Exceſs will produce 180, half whereof is 90 which deduct from the above mentioned Quotient 100, and the remainder will be £.10 the Anſwer.

Or multiply the number of Terms by the common Difference, and that product by the number of Terms leſs an Unit, ſubtract the laſt product from twice the Sum of the ſeries and divide the remainder by twice the number of terms; and the Quotient will be the leaſt Term.

See the Work.

From $1000 \times 2 = 2000$
Take $10 \times 20 \times 9 = 1800$
Diviſor $10 \times 2 = 20)\ 200$

£10 the Anſwer as above.

PRO-

PROPOSITION 8.

When one perſon *or* thing moves *with an* equal *and another the ſame way by a* progreſſive motion, *to find in what time* the firſt will be overtaken.

RULE.

To twice the ſpace gone o'er each day
By the purſu'd, mind what I ſay
Add th' common Exceſs, be what it will
O'th' purſuer's days journey, mind me ſtill,
From th' Sum take twice the ſpace gone o'er
By the purſuer the firſt day——more
Divide th' reſult by th' common Exceſs
Th' Quote will th' number of days expreſs
As the purſu'd will be o'erta'en
As quickly now I ſhall explain.

EXAMPLE

Suppoſe a Highwayman (ſuch as the late noted *Turpin*) committed a Robbery and ſuſpecting a purſuit rode off at the rate of 40 miles a day, now ſuppoſe a Thieftaker follow'd him in a progreſſive motion and rode 30 miles the firſt day, 34 the next and ſo on encreaſing 4 miles every day. In how many days wou'd the Highwayman be overtaken?

Firſt, 40 multipli'd by 2 produces 80 to which add 4 the common Exceſs and the Sum will be 84. *Then* from 84 deduct 60 *viz.* twice the Space the Purſuer was ſuppoſed to ride the firſt day, and the remainder will be 24 which divided by 4 (the common Exceſs) quotes 6 the anſwer, as may be eaſily proved, for $6 \times 40 = 240$ which by *Propoſition* 3, *page* 407, will be readily found to be the Sum of *that Series* whoſe firſt Term is 30, Number of Terms 6, and Common Exceſs 4, and therefore proves the above work to be right.

GEOMETRICAL PROGRESSION.

GEOMETRICAL PROGRESSION ſhews
When Ranks of Numbers we ſuppoſe
T' increaſe by equal Ratios—or
Decreaſe the ſame in Number,—for
Common Multipliers plainly ſhew
And Diviſors too—the Ratio.

A *Series* of *Proportional Numbers*, or *Proportionals* (by ſome called *Geometrical Proportionals*) is a Rank of Numbers (above two) that ſucceed each other increaſing or decreaſing regularly by a *Common Multiplier* or *Diviſor*.

Hence

1, 3, 9, 27, 81 } is a *Rank* or *Series* of *Proportionals* { inc. } by the *Common* { *Mult.* } 3
81, 27, 9, 3, 1 { dec. } { *Div.* }
2, 8, 32, 128, 512 { inc. } { *Mult.* 4
and
625, 125, 25, 5, 1 { dec. } { *Div.* 5

In any rank of Numbers in *Geometrical Progreſſion*, the *firſt* and *laſt Terms* are call'd *Extremes* and any *two equally diſtant* from them *Means* the ſame as in *Arithmetical Progreſſion* ſee *page* 405. Now when the Number of Terms of any *Geometrical Series* is even, it is plain that the *product* of the *Extremes* is always *equal* to *that* of every *two Means that are equally diſtant from them*, as in the Series

4, 8, 16, 32, } the *product* ariſing from the { *Extremes* 4 } and { 32 *viz.* 128
is *equal* to { *Means* 8 } { 16.—And if

the Number of Terms of any *Geometrical Series* be odd, then the *Square* of the *Mean* or *middle Term* is always *equal* to the *Product* of the *two Extremes* or

to

to *that* of any *two Means equally diſtant* from the *Mean* or *middle Term*, as in the Series 3, 12, 48, 192, 768 the *Square* of 48 the *Mean viz.* 2304 is *equal* or to the *Prod.* ariſing from the 2 *Extrs.* 3 and 768, *Means* 12 and 192

There are 5 things to be obſerved in a *Geometrical Series* (as well as an *Arithmetical One*) *viz.*

1. The first Term commonly the leaſt
2. The laſt Term commonly the greateſt
3. The Number of Terms
4. The Ratio
5. The Aggregate or Sum of all the Terms.

Any three of theſe being given the other two may be eaſily found.

PROPOSITION I.

When Unity is the firſt Term, *and the* Ratio *and* Number of Terms *are given to find the* laſt Term *without producing all the intermediate Terms.*

RULE.

A few of the leading Terms firſt find,
O'er which place th' Indices† to your mind.
Then find what figures of the Indices,
When added together true, that is, ——
Will give th' Index o' th' Term that's ſought,
Then multiply the Numbers wrote
Under ſuch Indices, into
Each other, and the Product 'll ſhew
The Term requir'd, as ſoon you'll know.

Note. You muſt take care to remember that the Sum of the Indices is always 1 leſs than the Number

† Indices or Exponents are a Series of natural Numbers which proceed from Unity or 1, and ſhew the places of the Terms of the Progreſſion.

of

of Terms, becauſe the Indices begin with a Cypher, and therefore

The Index { 1, 2, 3, 4 &c. } always ſtands over, and conſequently denotes the { 2d, 3d, 4th, 5th &c. } Term, as is manifeſt in all the Examples in *this* and the two following *Propoſitions*.

EXAMPLE.

Once *Country Ralph* a Horſe did buy,
'Twas of a Sharper *Obed Sly*,
And by agreement was to pay,
What the laſt Nail came to they ſay,
A Farthing for the firſt Nail he
Agreed to pay, th' ſecond muſt be
Doubled,——ſo on to th' Number eight. †
Come *Tyro* now you'll tell me ſtraight,
What *Ralph* was t' pay—the Sharper's claim
This do, and mount aloft to *Fame*.

† 4 Shoes and 8 Nails in each.

Firſt { 0, 1, 2, 3, 4, 5, 6, 7, 8 Indices or Exponents
1, 2, 4, 8, 16, 32, 64, 128, 256 Terms

and { 7 + 7 = 14
128 × 128 = 16384 the 14th Index or Exponent and conſequently the 15th Term.

Then { 14 + 14 = 28
16384 × 16384 = 268435456

2147483648 } the { 2 8 3 } Index, and conſequently the { 29th 4th 32d } Term.

Or

Or thus

First { 7 + 8 = 15
128 × 256 = 32768
2
65536 } the { 15th 1st } Index, and consequently the { 16th 2d / 16th 17th } Term.

Then { 15 + 16 = 31
32768 × 65536 = 2147483648 } the same as in the preceding *page* being the 32d, or last Term in Farthings, which make £2236962 2*s* 8*d* the price of the Horse or last Nail.

Too much by far, for honest *Ralph* to pay,
Who shou'd take care of Sharpers in this way,
An honest man may easily be undone,
By giving way to such a Sharper's Pun.

Note. The abovementioned sum of £2236962 2*s* 8*d* you see is only the price of the last Nail, but the Sum of the Terms *viz* What all the 32 Nails will amount to, may be easily known by *Proposition* the 3d in *page* 418 to be 4294967295 Farthings = £4473924 5*s* 3$d\frac{3}{4}$.

PROPOSITION 2.

When the first Term *of any Geometrical Series is* greater than Unity, *and* that Term, *the* Number of Terms *and* Ratio *are given to find the* last Term *without producing all the intermediate Terms.*

RULE.

Here as in Rule the last proceed,
Only in this, you must take heed,
Ev'ry Product must divided be
By the first Term, the Quote you'll see.
Will with the Term requir'd agree.

EXAM-

EXAMPLE.

Suppose a person had 9 Sons and leaves the youngest £100, the next as much and half as much, and so every Son to exceed the next younger by the equal Ratio of $1\frac{1}{2}$. What is the eldest Son's share?

First { 0, 1, 2, 3, 4 Indices
100, 150, 225, 337.5, 506.25 Terms

and { $4 + 4$
$506.25 \times 506.25 = 256289.0625$.

Then divide 256289.0625 by 100 the first Term and the Quotient will be $2562.890625 = £2562\ 17^s\ 9^d\frac{3}{4}$ the Answer.

PROPOSITION 3.

When the first Term, Number of Terms *and* Ratio *are given to find the* Sum of all the Terms *or* Series.

RULE.

Now find the last Term as before,
From which deduct the first, not more,
Th' remainder by th' Ratio divide
Less one — And to that Quote beside,
Add the last Term, and you will find
The Sum required to your mind.

Hence it is plain that in any finite Geometrical Progression it holds

As | the | Ratio *minus* Unity | to | Unity | to
Or, As | the | Diff. o'th' 2 greatest Terms | to | the greatest | to

the { Diff. of the greatest and least Terms. / greatest *minus* the least } to the Sum of all except the { greatest. / least.

EXAM-

Example 1.

Fair *Chloe*'s married to a 'Squire,
Who does her beauteous form admire.
Her Father whimsical inclin'd,
His Daughter portion'd thus we find,
Ten Shillings on the wedding Day,
And doubled ev'ry Month they say,
For one whole Year, what was the Sum?
Come *Tyro* work, the Answer'll come.

First { 0, 1, 2, 3, 4, 5, 6 Indices
10, 20, 40, 80, 160, 320, 640 Terms

and { 5 + 6
320 × 640 = 204800 *Then* divide 204800 by the first Term 10, and the Quotient will be 20480 the last Term, from which deduct the first Term and (as the Ratio *minus* Unity is just an Unit, therefore) to the remainder 20470 add 20480 the last Term, and the Sum will be 40950 Shillings = £2047 10*s* the Ans.

Or, according to the first mentioned *Analogy* in the preceding *page*. As the Ratio *minus* Unity *viz.* 1 is to Unity or 1 so is 20470 the Difference of the greatest and least Terms, to 20470 the Sum of all except the greatest, *Hence* is manifest this

Corollary

That if the Ratio of any Rank or Series of Proportionals be double, the Difference of the greatest and least Terms is equal to the Sum of all except the greatest, if the Ratio be triple, the Excess or Difference is double the Sum of all except as aforesaid, if quadruple, triple, if quintuple, quadruple, and so on.

Example 2.

Suppose a Labourer was to agree with a Farmer to thrash his Barley be what Quantity it wou'd for 20 Years, upon condition he wou'd give him 4 Barley Corns for the first Year, 12 for the second, 36 for the third,

third, and so on to the end of the 20 Years. What wou'd his Wages amount to allowing 7680 Grains to a Pint, and 64 Pints to the Bushel and the whole Quantity to be worth 3*s* 10*d per* Bushel?

First { 0, 1, 2, 3, 4, 5 Indices
4, 12, 36, 108, 324, 972 Terms

and { 5 + 5
972 × 972 = 944784 which } divided by { 4 the first Term } quotes { 236196 } the { 10th } Index, and consequently the { 11th } Term.

Then { 10 + 10
236196 × 236196 = 55788550416 which } divided by { the Ratio } quotes { 13947137604 } the { 20th } Index, and consequently the { 21st } Term.
and the 21st Term *viz.* 13947137604 } { 4649045868 } { 19th } { 20th }

Or thus,

First { 4 + 5
324 × 972 = 314928 which } divided by 4 the 1st Term quotes { 78732

and { 9 + 9
78732 × 78732 = 6198727824 which } divided by the 1st Term quotes { 15496819563 Ratio } the { 9th, 18th } Index and consequently the { 10th, 19th } Term.
4649045868 } { 19th Index } { 20th }

Then (according to the *Rule* and alſo to the *firſt Analogy* in *page* 418, they being both one and the ſame in effect) deduct 4 the firſt or leaſt Term from 4649045868 the laſt or greateſt Term, and divide the remainder 4649045864 by 2 *viz*, the Ratio leſs 1, and the Quotient will be 2324522932 the Sum of all the Terms except the laſt or greateſt, to which add 4649045868 the laſt or greateſt Term, and the Sum will be 6973568800 the Sum of all the Terms or the whole Number of Barley Corns.

O R, according to the *ſecond Analogy* in *page* 418.

As 4649045868 — 1549681956 = 3099363912 *viz.* the difference of the 2 greateſt Terms, is to 4649045868 the greateſt Term, ſo is 4649045868 — 4 = 4649045864 *viz.* the greateſt Term *minus* the leaſt, to 6973568796 the Sum of all the Terms except the leaſt, to which add 4 the leaſt Term, and the Sum will be 6973568800 the Number of Barley Corns the ſame as before, which divide by 491520 = $\overline{7680 \times 64}$, and the Quotient will be 14187 $\frac{2341}{3072}$ *viz.* 14187 Buſhels and a little more than 3 Pecks, which at 3*s* 10*d* a Buſhel amount to £2719 6*s* 5*d* the Anſwer.

PROPOSITION 4.

When the firſt Term *and* Ratio *of any* infinite decreaſing Geometrical Series *or* infinite Series of decreaſing Proportionals *are given to find the* Sum of the Series.

RULE.

Divide the Square o' th' firſt Term true,
By th' diff'rence, which the firſt doth ſhew
And th' ſecond Term i'th' Series too.
This done, the Quotient will appear
The Sum o' th' Series very clear.

A *Geometrical Series* that decreaſeth *ad infinitum* or in other words an *Infinite Series* of *decreaſing Proportionals* is ſuch whoſe *laſt* or *leaſt Term* is a *Cypher* or *leſs than any thing* aſſignable, and its *Number of Terms inexpreſſible*; and that the Sum of *ſuch a Series* whoſe ſeveral Terms are *utterly impoſſible to be expreſſed* can be ſo eaſily known as is ſet forth in the *Rule* in the preceding *page*, or indeed known at all! ſeems *VERY WONDERFUL!* but that it may be ſo eaſily done is plain from the *ſecond Analogy* in *p.* 418 *viz.* As the difference of the two greateſt Terms, is to the greateſt, ſo is the greateſt *minus* the leaſt, to the Sum of all except the leaſt. Now as in an *infinite decreaſing Series* the laſt or leaſt Term is a Cypher (as above) therefore there is nothing to be ſubtracted from the greateſt Term, and conſequently in ſuch a Series it muſt be, As the difference of the two greateſt Terms is to the greateſt, ſo is the greateſt, to the Sum of all, whence is derived the *Rule* in the preceding *page*.

Or the Sum of ſuch a Series may be known by the following *Analogy*, *viz.* As the difference of the two firſt or greateſt Terms, is to the ſecond Term, ſo is the firſt or greateſt Term, to the Sum of all the others *ad infinitum*.

Example.

Find the Sum of the Series $\frac{1}{4}$, $\frac{1}{16}$, $\frac{1}{64}$, $\frac{1}{256}$ &c. *ad infinitum*.

Firſt $\frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$, and $\frac{1}{4}$ (*viz.* $\frac{4}{16}$) $- \frac{1}{16} = \frac{3}{16}$.

Then $\frac{3}{16}) \frac{1}{16} (\frac{16}{48} = \frac{1}{3}$ the Anſwer.

Or (according to the laſt mentioned *Analogy*) As $\frac{3}{16}$ the difference of the two firſt or greateſt Terms, is to $\frac{1}{16}$ the ſecond Term, ſo is $\frac{1}{4}$ the firſt or greateſt Term, to $\frac{16}{192} = \frac{1}{12}$ the Sum of all the Terms except the firſt or greateſt, to which add $\frac{1}{4}$ the firſt or greateſt, and the Sum will be $\frac{4}{12} = \frac{1}{3}$ the Anſwer as before.

Pro-

PROMISCUOUS QUESTIONS.

Question 1.

From Mr. *Donn's* Arithmetic, *page* 209.

A Gentleman as he did ride
Near to a pleaſant Common ſide,
Ten Shepherdeſſes chanc'd to meet,
Driving their Flocks, whom he did greet,
God ſpeed you well; and may you be
As happy as you're fair (ſaid he:)
Proſper your Flocks, and may they thrive;
Tell me how many Sheep you drive?
One of the Damſels ſtraight reply'd,
Sir, you ſhall ſoon be ſatisfy'd.
For if for one of us you do
Count one Sheep, for the next count two,
For the third four, for the fourth eight,
So doubling at each Maid aright,
At the laſt Maid the Sum will be,
As many as the Sheep you ſee.

Quere the Number of the Sheep?

Firſt { 0, 1, 2, 3, 4, 5 Indices
{ 1, 2, 4, 8, 16, 32 Terms

and { $4 + 5 = 9$
{ $16 \times 32 = 512$ the Number of Sheep requir'd.

Or thus,

$$4 + 3 + 2 = 9$$

therefore $16 \times 8 \times 4 = 512$ as before, and here we may obſerve that whatever Indices we take whoſe Sum is under the laſt Term, the powers of the Ratio under ſuch Indices multiplied into each other will be equal to the power of the Sum of ſuch Indices or Exponents.

Queſtion 2. by Mr. *John Newbold.*

From Mr. *Tipper*'s Delights for the Ingenious, publiſhed in 1711.

Suppoſe a round Ball for to move in the Air,
In a certain proportion which I ſhall declare;
Let the firſt Hour be 12 Miles, the next to move 10,
And ſo in proportion from whence it began,
As 12 is to 10, now try if you can
Tell the Miles it will move, ſuppoſe it to be
Continued in Motion to *ETERNITY!*

Firſt $12 \times 12 = 144$, and $12 - 10 = 2$. *Then* divide 144 Miles by 2 and the Quotient will be 72 Miles the Anſwer.

Or, As 2 the difference of the two greateſt Terms, is to 10 the ſecond Term, ſo is 12 the firſt or greateſt Term, to 60 Miles the Sum of all the Terms except the firſt or greateſt, to which add 12 Miles the greateſt Term, and the Sum will be 72 Miles the Anſwer the ſame as above.

PERMUTATION.

THIS *Rule* will ſhew you inſtantly,
How th' order of things may varied be,
With reſpect to place, as you will ſee.

RULE.

All th' given Series multiply
One into another continually.
Then the laſt product points out fair
The Anſwer true I do declare.

EXAM-

EXAMPLE 1.

At *Whitchurch* we've a Church that's nearly new,
Which beauteous Pile, can be outvi'd by few:
Here ſacred Grandeur, captivates the Eye,
Trav'lers admire the ſame, as they paſs by;
To grace this Structure, there's a lofty Tow'r,
With eight fine Bells, which harmonize each Bow'r.
How many Changes may be rung declare,
On theſe eight Bells, and likewiſe tell me fair,
How long they wou'd be ringing them once o'er,
Allowing eight Seconds *per* Change, not more?

Firſt $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 = 40320$ | the No. of | Changes

Then $40320 \times 8 = 322560$ | | Sec. = 89 Hours and 36 Minutes the time the 40320 Changes wou'd be in ringing once over, admitting 1 Change to be rung in 8 Seconds.

EXAMPLE 2.

How often might a Family of 12 perſons dine together, and be placed every day in a different Poſition?

$1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 \times 11 \times 12 = 479001600$ Days, which (at 365 Days to the Year) are equal to $1312333\frac{11}{73}$ Years the Anſwer.

SCHOLIUM.

I ſhall conclude this *Rule* with two Queſtions in *Combinations*, the firſt from *Ladies Diary*, 1711, and the ſecond from Mr. *Birks'* Arithmetic, who gives the following

RULE.

" Having placed the given Quantity by itſelf, de-
" creaſe it gradually by an Unit, ſo often as there are
" quantities in the Combinations; placing them one

" after another, with a ſign of multiplication between " them, which numbers muſt be multiplied into one " another for a dividend: then placing an Unit " with the like number of places, increaſing by Uni- " ty 'till you arrive at the Number to be combin'd; " which multiply continually for a Diviſor, and the " Quotient will be the Number of Combinations " ſought."

Queſtion 1. by Mr. *William Hawney.*

Ladies Diary, 1711.

A famous Gen'ral having ſerv'd his King,
Who, always from the Wars did Vict'ry bring,
For this good Service (with a pleaſant ſmile,)
Aſk'd of his King, one farthing for each file
Of ten Men in a file, which he cou'd then
Make with a Body of one hundred Men.
The King, conſid'ring his brave Actions paſt,
And ſeeming Modeſty of his requeſt,
Gave his conſent—To what will it amount
In *Sterling* Money? take your Pen and count.

$$\frac{100}{1}\times\frac{99}{2}\times\frac{98}{3}\times\frac{97}{4}\times\frac{96}{5}\times\frac{95}{6}\times\frac{94}{7}\times\frac{93}{8}\times\frac{92}{9}\times\frac{91}{10}=$$

$$\frac{628156509555294720000}{3628800}=173103094564^{40}$$

£ s d

Farthings, which are equal to 180315723509 2 the Anſwer.

Queſtion 2. by Mr. *Birks.*

In *Lincolnſhire*, where bounteous Nature yields
Fat ſheep and oxen, and luxuriant fields;
Our gen'rous clime, replete with roſy health,
Choice friends afford, bright, fair, & plenteous wealth.
Some fenny ground have we, with flocks of geeſe,
Yielding five times a year, their feather'd fleece.

On

On which devoid of care, Swains ſleeping lie,
After repaſt of ſav'ry giblet-pye.
One day at *Boſton* o'er a jug of ale,
A *Goſſard* offer'd all his flock to ſale
At fifteen pence a piece, but I propos'd
A diff'rent price, with which he quickly clos'd.
(The geeſe are mark'd by cutting toe or heel,
The webs are pierc'd or ſlit with ſharpen'd ſteel.)
An hundred pounds for juſt as many geeſe,
As may be diff'rent mark'd: What's that a piece?

As each gooſe had 3 toes, 2 webs and 1 heel on each foot, there were 12 different things to be mark'd, but as the 4 webs might be either ſlit or pinched; but not both together, therefore $2\times2\times2\times2\times2\times2\times2\times2\times2=256$ and $3\times3\times3\times3=81$.

Now $256\times81=20736$ } the No. of { Combinations
and $20736-1=20735$ } the No. of { Marks or Geeſe

	Geeſe.	£	*Gooſe:*	*d*
Then As	20735 :	100 ::	1 :	$1\frac{653}{4147}$ the Anſwer.

SINGLE POSITION;

Or, the Single *Rule* of *Falſe*.

POSITION is ſo call'd, becauſe
Uncertain Numbers we ſuppoſe
To reaſon with, and by them gain
True Numbers ſought—'tis very plain.

Single Poſition diſcovers the truth by one ſuppoſed Number, and is wrought by the following

RULE.

Chooſe your Poſition, then prepare
To work as if the Number were

The

The true one, and perhaps you'll ſee
Th' reſult will not with truth agree,
Then this proportion there muſt be,
As th' reſult of your Poſition's to
The ſame Poſition taken,——ſo
The given Number 'll always be,
Unto the Number ſought you'll ſee.

EXAMPLE 1.

At a certain School if you add $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{5}$ of the Number of Scholars together the ſum will be 76. *Quere* the Number of Scholars?

Suppoſe the Number of Scholars were 100, then $\frac{1}{2}$ $\frac{1}{4}$ and $\frac{1}{5}$ thereof wou'd be 95 which (by the Queſtion) ſhou'd have been only 76, therefore

	Sch.	*Sch.*	*Sch.*	*Sch.*
As	95 :	100	:: 76	: 80 the Anſwer.
Or As		76	100	

EXAMPLE 2.

Near *Marbury* within a Cottage tarry,
Old *Simon* with his Daughters *Ruth* and *Mary*.
The one hath charms to captivate the mind,
The other's handſome, and to love inclin'd,
Oft, though in vain, a neighb'ring *Swain* hath try'd
To gain conſent to have one for his bride,
But the morouſe, old peeviſh Man won't give
Conſent, as long as ever he doth live.
Like Nuns who're in a Nunnery confin'd,
He keeps his Daughters cloſe from all mankind.
All lovers from his houſe, he makes to run,
With ruſty Rapier, Blunderbuſs, or Gun.
While *Simon* lives, each Daughter muſt obey,
Hard Lot! for them, we cannot chooſe but ſay.

The

The Father's and the Daughters Age you'll find,
From what you ſee is underneath ſubjoin'd, *
Which being found, pity the maidens cauſe,
Who muſt obey, a churliſh Father's laws.

yrs.

Suppoſe 20 to { wou'd be the { eldeſt / youngeſt } daughter's Age.

Then (*per* Q.) 20 — 2 = 18 } wou'd be the youngeſt daughter's Age.
and 20 + 18 = 38 } wou'd be the Father's Age.

The Sum whereof is 76 which (per Queſtion) ſhou'd have been 124, therefore

yrs yrs yrs yrs.

As 76 : 38 :: 124 : 62 the Father's Age, which being taken from 124 (the ſum of all their Ages) leaves 62 the ſum of the two Daughter's Ages, and as the one Daughter is 2 years older than the other, conſequently 32 and 30 muſt be their reſpective Ages.

Example 3.

A perſon being aſked what number of Shillings he had in his pocket, reply'd if I had as many, $\frac{1}{2}$ as many and $\frac{1}{4}$ as many, I ſhou'd have 275. How many Shillings had he?

Suppoſe he had 60 Shillings, then as many, $\frac{1}{2}$ as many, and $\frac{1}{4}$ as many wou'd make 165, which (by the Queſtion) ſhou'd have been 275, therefore

s. s. s. s.

As 165 : 60 :: 275 : 100 the Anſwer.

---

* The Father's Age is equal to the Sum of both the Daughter's Ages, the one Daughter is 2 years older than the other, and the Sum of all their Ages is 124.

Exam-

EXAMPLE 4.

An old Woman of above threeſcore and ten,
Has buried four huſbands, and married again
To *Jerry* the Mugman,—a Bagpiper Rare!
And none can with him for his muſic compare.
The muſic he play'd pleas'd the old woman much
'Till ſhe hopp'd and ſhe caper'd about without crutch,
Though wrinkled and wither'd—no tooth in her head
Yet money ſhe had and ſhe got married,
To his Bagpipes ſhe mov'd, with one foot in the grave
For all her delight was a huſband to have!
The ſum of both ages one hundred years are
Wanting five— and one fourth of her Age I declare,
Is the Age of the huſband—now *Tyro* you'll find,
The Bagpiper's Age with his Spouſe's ſo kind.

Suppoſe 80 to } the { Wife's } Age
Then (*per* Q.) 20 wou'd } be { Huſband's }

The ſum whereof is 100 which (by the Queſtion) ſhou'd have been only 95, therefore

yrs yrs yrs yrs
As 100 : 80 :: 95 : 76 } the { Wife's } Age
Then (*per* Q.) ¼76 = 19 } { Huſband's }

PROMISCUOUS QUESTIONS.

Queſtion 1. by Mr. *Charles Hutton.*

A Gentleman diſtributed 78 pence among a number of poor People, conſiſting of Men, Women and Children, to each Man he gave 6*d*, to each Woman 4*d*, and to each Child 2*d*, moreover there were twice ſo many

many Women as Men, and thrice ſo many Children as Women: How many were there of each?

						d		*d*
Suppoſe 6 to		would be the No. of	Men	which at	6	each, would receive		36
Then (*per* Q.)	12		Women		4			48
and	36		Children		2			72
							The Sum whereof is	156

but the Sum diſtributed was only 78*d*, therefore

		d	*Men*	*d*			
	As 156	: 6	:: 78	: 3			
Then (*per* Qu.)	3 × 2	= 6			the No. of	Men	
and	6 × 3	= 18				Women	
						Children	

Note. As it happens that the Reſult of the Poſition taken is 156 *viz.* exactly twice as much as the number of Pence diſtributed, therefore the half of the Suppoſition 6 *viz.* 3 muſt be the number of Men relieved.—The Proof of Queſtions belonging to this Rule being ſo very eaſy that it is unneceſſary to ſay any thing relating thereto.

Queſtion 2. by Mr. *Leybourn.*

See his *Curſus Mathematicus, page* 52.

One delivered into the hands of a Truſtee for a Child's Portion, a certain Sum of Money to be paid to the party at the expiration of 10 years with the Profit of the ſame Sum at £6 *per Cent.* Simple Int. and at the end of the 10 years the party received £450. What was the ſum of money that was put into the Truſtee's Hands?

Suppoſe the Principal or Sum delivered to the Truſtee was £150, the Intereſt whereof for 10 years at £6 *per Cent* is £90, which add to £150, and the Sum or Amount will be £240, which (according to the Queſtion) ought to have been £450, therefore

	£	£	£	£	*s*
As 240	: 150	:: 450	: 281	5	the Anſwer.

DOU-

DOUBLE POSITION.

TO work this *Rule*, you'll quickly ſee,
Two ſuppoſitions there muſt be
By means of which the number's found
That's ſought——as quickly I'll expound.

RULE.

Two ſuppoſitions make, and ſee
How with your Queſtion they agree,
By working with them, as if they
Were the true numbers ſought, I ſay—
How much th' *Reſults* are diff'rent find,
From *that* i'th' Queſtion—*Tyro* mind—
Th' diff'rences or errors multiply,
Croſſwiſe the ſuppoſitions by.
Now if the errrors do agree,
That is, if *both the Reſults* ſhall be
Greater or leſs (as you may ſee)
Than is th' *Reſult*, i'th' Queſtion——then
Th' Diff'rence o'th' products is th' dividend,
Which when it is divided true
By *th' Diff'rence* o'th' errors—*Tyro* you
Will have an Anſwer in your view.
But if the errors diſagree
That is, if th' one *Reſult* ſhall be,
Too much, *th' other* too ſmall you ſee,
The *Sum* of the two products, then
Moſt certain, is your dividend,
And *th' Sum* o'th' errors then moſt clear,
Is your diviſor—ſo take care,
For th' quote's the Anſwer I declare.

EXAMPLE I.

A merry old workman, a thraſher of corn,
Agreed with a Farmer, one *Anthony Horn*,

To

To thraſh him his Wheat, at ten groats for a Score,
Two and ſixpence his Barley, th' Sum was no more,
One hundred Buſhels he thraſh'd to his mind
And then he received the ſum here ſubjoin'd. * } 14s 2d
How much of each ſort, then be pleaſed to find }
Did he thraſh, e're he call'd for a full flowing bowl,
For like *Stephen Duck*, he's a tippling ſoul.

				s	d		d
Suppoſe 60 to	be the No. of Buſh. of	Wh.	thethraſh. ing of	3	4	*per* Score amts. to	120
Then (*per* Q.) 40 wou'd		Bar.	which, at	2	6		60

The Sum of which is 180
which ſhou'd be only 14s 2d = 170
First Error 10

				s	d		d
Again, Suppoſe 56 to	be the No. of Buſh. of	Wh.	thethraſh. ing of	3	4	*per* Score amts. to	112
Then (*per* Q.) 44 wou'd		Bar.	which, at	2	6		66

The Sum of which is 178
which ſhou'd be only 14s 2d = 170
Second Error 8

Whence according to the *Rule*

From 56		10		560
Take 60	×	8	=	480

60 56
X (40
10 8

and the *diff.* of the Prod. is 80 which divide by 2 the *dif-*

difference of the Errors, and the Quotient will be 40 the number of Buſhels of Wheat, and conſequently 60 muſt be the number of Buſhels of Barley, as is eaſily prov'd

									s	*d*		*s*	*d*
for	the thraſhing of	40	Buſhels	of	Wheat	at	3	4	*p.* Score	amts. to	6	8
and		60			Barley		2	6			7	6

The qty. thraſh'd *viz* 100 Buſh. wch. *p.* Q. amts. to 14 2

Solution when *both the Errors* are in *defect viz.* when the *Reſult* of both Suppoſitions are *too little.*

Suppoſe 26 to } be the No. of Buſhels of { Wheat
Then (*per* Q.) 74 wou'd } be the No. of Buſhels of { Barley

with which proceed according to the conditions of the Queſtion (the ſame as in the preceding *page*) and the Reſult will be found to be only 163, which is *too little* by 7 the firſt Error.

Again, Suppoſe 20 to } be the No. of Buſhels of { Wheat
Then (*per* Qu.) 80 wou'd } be the No. of Buſhels of { Barley

with which proceed according to the Conditions of the Queſtion and the Reſult will be found to be only 160 which is *too little* by 10 the ſecond Error. Then agreeable to the *Rule*, the Errors being of the *ſame kind*,

From 26	the	1ſt	Suppoſition	multiply'd by	10	the	2d	Error	=	260
Take 20		2d			7		1ſt			140

and the *Difference* of the Products will be 120 which divide by 3 the *Difference* of the Errors, and the Quotient will be 40 the Number of Buſhels of Wheat the ſame as in the preceding *page*.

Solution

Solution with an *Error* of *Defect* and *Excess viz.* when the *Result* of one Supposition is *too little* and the other *too great.*

Suppose 34 to } be the No. of Bushels of { Wheat
Then (*per* Qu.) 66 wou'd } be the No. of Bushels of { Barley

The Result whereof according to the Conditions of the Question will only be 167, which ought to have been 170 and therefore is *too little* by 3 the first Error.

Again, Suppose 80 to } be the No. of Bushels of { Wheat
Then (*per* Qu.) 20 wou'd } be the No. of Bushels of { Barley

The Result whereof according to the Conditions of the Question will be found to be 190, but shou'd only be 170, and therefore is *too much* by 20 the second Error. Then agreeable to the *Rule*, as the Errors are of a *different kind*,

To 34 } the { 1st } Supposition multiplied by { 20 } the { 2d } Error = { 680
Add 80 } the { 2d } Supposition multiplied by { 3 } the { 1st } Error = { 240

and the *Sum* of the Products will be 920 which divide by 23 the *Sum* of the Errors, and the Quotient will be 40 the number of Bushels of Wheat, the same as before. And thus you see let the Errors happen *how they will*, the Answer may be easily obtained by paying a due regard to the *Rule* in *page* 432, and from whence is deduced this

COROLLARY

As } the { *Diff.* } of the Errors if they are of { the *same* } *kind*
Or As } the { *Sum* } of the Errors if they are of { a *different* } *kind*

is to the Difference of the Suppositions, so is the least Error to the Correction of the Supposition belonging

to this Error, which muſt be added to or ſubtracted from ſuch Suppoſition according to the following Conditions *viz.*

If the Errors be of the *ſame kind* and the Suppoſition belonging to the leaſt Error

be { *gr.* / *leſs* } than the other Suppoſition { *add* / *ſub.* } the Correction { to / fr. } its Suppoſition, and the { *Sum* / *Diff.* } will be the Anſwer.

But if the Errors be of a *different kind* and the Suppoſition belonging to the leaſt Error

be { *gr.* / *leſs* } than the other Suppoſition { *ſub.* / *add* } the Correction { fr. / to } its Suppoſition, and the { *Diff.* / *Sum* } will be the Anſwer.

In the *firſt Solution* of the preceding Queſtion in *page* 433,

the { 1ſt / 2d } Suppoſition is { 60 / 56 } and its Error { 10 / 8 } in Exceſs.

Now the Errors being of the *ſame kind* or *affection* therefore (according to the beforementioned *Corollary*) the *Analogy* will be As 2 the *Difference* of the Errors (becauſe they are of the *ſame kind*) is to 4 the Difference of the Suppoſitions, ſo is 8 the *leaſt Error*, to 16 the Correction of the Suppoſition belonging to this Error, which *ſubtract* from its Suppoſition 56 (becauſe the Errors are of the *ſame kind*, and the Suppoſition belonging to the leaſt Error is *leſs* than the other Suppoſition, ſee the *Corollary*) and the *Remainder* will be 40 the Number of Buſhels of Wheat the ſame as in the preceding *page*.—The Proof of the other two *Solutions* by the abovementioned *Corollary* is ſo eaſy that it is needleſs to inſert it.

EXAM-

EXAMPLE 2.

Three perſons *A*, *B* and *C* ſpent a certain Sum at an Alehouſe, and at paying the Reckoning; *A* threw down *a Crown* and *one fifth* of the whole, *B* threw down *one fourth* of the whole, and *C* paid the reſt, being *three tenths* of the whole. What was the Reckoning, and what did each pay?

Suppoſe the Sum ſpent was 8*s*, then (*per* Queſtion) $5+1.6+2+2.4=11$ which ought to have been but 8 therefore $11-8=3$ is the firſt Error.

Again, Suppoſe the Sum ſpent was 15*s*, then (*per* Queſtion) $5+3+3.75+4.5=16.25$ which ought to have been but 15, therefore $16.25-15=1.25$ is the other Error.

Now as the Errors are of the *ſame kind*, therefore according to the *Rule* in *page* 432.

$$\left.\begin{matrix}\text{From } 15\\ \text{Take } 8\end{matrix}\right\} \times \left\{\begin{matrix}3\\ 1.25\end{matrix}\right\} = \left\{\begin{matrix}45\\ 10\end{matrix}\right. \qquad \begin{matrix}8 & 15\\ \times & \\ 3 & 1.25\end{matrix} \quad (20$$

and the *Diff.* of the Prod. will be 35 which divide by 1.75 the *Difference* of the Errors, and the Quotient will be 20 the Number of Shillings ſpent, whereof *A* paid a Crown and $\frac{1}{5}=9s$, *B* paid $\frac{1}{4}=5s$ and *C* paid the reſt *viz.* $\frac{3}{10}=6s$, which ſeveral ſhares added together make 20*s* the whole Reckoning, the ſame as above.

Note. The above Queſtion I propos'd in *Palladium* 1767, and which was anſwer'd nearly in the above manner by Maſter *John Flint*, an ingenious pupil of Mr. *Nathaniel Brownell's* of *Coventry*, under whoſe *Solution* is a general Rule (the ſame in ſubſtance or

meaning, as that which I have given in verſe in *page* 432) and the following lines.

" Errors *unlike*, Addition uſe,
" But when *alike*, Subtraction chooſe."

Solution of the Queſtion by the *Corollary* in *page* 435.

As 1.75 the *Difference* of the Errors (becauſe they are of the *ſame kind*) is to 7 the Difference of the Suppoſitions, ſo is 1.25 the leaſt Error, to 5 the Correction of the Suppoſition belonging to this Error, and now as the Errors are of the *ſame kind*, and the Suppoſition belonging to the leaſt Error is *greater* than the other Suppoſition, therefore (purſuant to the directions of the abovementioned *Corollary*) *add*, the Correction 5, to its Suppoſition 15, and the *Sum* will be 20 the Number of Shillings ſpent, the ſame as in the preceding *page*.

But this Queſtion may be very eaſily ſolved (and indeed ſo may many curious things) by *Vulgar Fractions* only, for the Shares or Fractions in this Queſtion *viz.* $\frac{1}{5}$, $\frac{1}{4}$ and $\frac{3}{20}$ (reduced to a Common Denominator by the *Note* to *Caſe* 9 *page* 251 and) added together make $\frac{15}{20}=\frac{3}{4}$ which being all the Reckoning except the 5*s* that *A* paid over and above the $\frac{1}{5}$, it is therefore very plain that 5*s* muſt be $\frac{1}{4}$ of the Reckoning and conſequently $5\times4=20$ Shillings the whole of it, the ſame as before.

Example 3.

Inſcrib'd to the Ladies.

Hail, lovely *Nymphs!* while I this tale impart,
Cupid, a *Swain* hath wounded to the heart,
'Tis an inconſtant *Fair*, his ſuit denies,
His humble ſuit, nay all his art defies.

His

His name fair *Ladies* if you chuſe to know,
It may be found from what appears below, *
Which being known, pity the ſlighted *Swain*,
Who's fetter'd ſtrong in love's tormenting chain.

Suppoſe the firſt letter's place to be 2, then (*per* Qu.) $2+2\times3+2+2=12$ but ought to be 22, therefore $22-12=10$ is the firſt Error and is in *Defect*.

Again, Suppoſe the firſt Letter's place to be 6, then (*per* Qu.) $6+6\times3+2+6=32$ which ought to have been but 22, therefore $32-22=10$ is the ſecond Error but is in *Exceſs*. Now as the Errors are of *different kinds* or *affections*, therefore according to the *Rule* in *page* 432,

2 6

To $2\times10=20$

Add $6\times10=60$

and the *Sum* of the Prods. will be 80 which divide by 20 the *Sum* of the Errors, and the Quotient will be 4 the firſt Letter's place.

10 10 (4

——But here it may be obſerved, that when the Errors happen to be *alike* in *Quantity* but *unlike* in *Quality* (as in this *Solution*) the Anſwer may be more eaſily obtained than by proceeding as above, for in ſuch Caſe, half the Sum of the Suppoſitions will be the Number ſought as in this *Solution*; the Sum of the Suppoſitions 2 and 6 is 8, half whereof is 4 the firſt Letter's place, the ſame as above.

---

* This perſon's Name conſiſts of three Letters, the firſt and third are the ſame, the ſecond Letter's place in the Alphabet is 3 times *that* of the firſt or third more 2, and the Sum of the places of all the 3 Letters is 22.

And

And here I wou'd just observe that it is *oftentimes* (if not always) of great advantage (by saving a deal of work in most Solutions) to make a *Cypher* and an *Unit* the two Suppositions, as in the preceding Question, Suppose the first Letter's place to be 0, then (*per* Qu.) $0+\overline{0\times3}+2+0=2$ which ought to have been 22, therefore $22-2=20$ is the first Error, and is in *Defect*.

Again, Suppose the first Letter's place to be 1, then (*per* Qu.) $1+\overline{1\times3}+2+1=7$ which ought to have been 22, therefore $22-7=15$ is the other Error, and is also in *Defect*. Now the Errors being of the *same kind* therefore according to the *Rule* in *page* 432,

$$\begin{array}{lcc} & 0 & 1 \\ \text{From } 1\times20=20 & & \\ & & \mathbf{X} \quad (4 \\ \text{Take } 0\times15=\ 0 & & \\ \hline & 20 & 15 \end{array}$$

and the *Diff.* of the Prod. will still be 20 which divide by 5 the *Difference* of the Errors, and the Quotient will be 4 the first Letter's place, the same as above.

Now the first Letter's place being 4 the 2d (by the Qu.) must be $\overline{4\times3}+2=14$ and the 3d, or last, the same as the 1st *viz.* 4 $\left.\begin{matrix}4\\14\\4\end{matrix}\right\}=\left\{\begin{matrix}D\\O\\D\end{matrix}\right.$ whence *D O D* is the person's Name.

To the inconstant Celia.

When pretty Maids inconstant prove,
The youthful Swains must die for love,
O! gentle *Fair!* to *D O D* be kind,
And ease his wild distracted mind.

EXAMPLE 4.

Old *Simon*'s dead, and *Margery* is found
A bucksome Widow with a *thousand Pound*,

'Cause

'Cauſe ſhe hath *Gold*, many a courting go,
Both *Old* and *Young*, the *Clown* and *fribbling Beau*,
She treats them kindly, *Ladies* you muſt know.
Her Age and Number of Sweethearts you'll find,
From what you ſee is underneath ſubjoin'd. *

Suppoſe o for the Number of Sweethearts, then (*per* Qu.) $\overline{o \times 6 + 10} = 10$, one fourth of which is 2.5 which add to o and the Sum will ſtill be 2.5 which ought to have been 65, therefore $65 - 2.5 = 62.5$ is the firſt Error, and in *Defect*.

Again, Suppoſe the Number of Sweethearts to be 1 then (*per* Qu.) $\overline{1 \times 6 + 10} = 16$, one fourth whereof is 4 which add to 1 and the Sum will be 5 which ſhould have beeen 65, therefore $65 - 5 = 60$ is the other Error, and in *Defect* alſo. Now the Errors being both of the *ſame kind*, therefore according to the *Rule* in *page* 432,

From $1 \times 62.5 = 62.5$

Take $o \times 60 = o$

and the *Diff.* of the Prods. will ſtill be 62.5

o 1
62.5 60

(25

which divide by 2.5 the *Difference* of the Errors, and the Quotient will be 25 the Number of Sweethearts.

Or according to the *Corollary* in *page* 435. As 2.5 the *Difference* of the Errors (becauſe they are of the *ſame kind*) is to 1 the Difference of the Suppoſitions, ſo is 60 the leaſt Error, to 24 the Correction of the

* Six times the Number of Sweethearts *more* ten is juſt four times the Widow's Age, and the Sum of both is 65.

Suppoſition

Suppoſition belonging to this Error, which Suppoſition being *greater* than the other, and the Errors of the *ſame kind*, therefore (purſuant to the beforementioned *Corollary*) *add* 24 the Correction, to its Suppoſition 1, and the *Sum* will be 25 the Number of Sweethearts, as before, and conſequently

$\frac{25\times6+10}{4} = 40$ muſt be the Widow's Age.

In Anſwer to this Queſtion the undermentioned *Gentlemen* have written in the *Ladies Diary* for 1765 as under.

Mr. *Malachy Hitchens.*

Margery's Age is forty Years,
Her Sweethearts five and twenty;
How plainly *Avarice* appears,
In bringing her ſuch plenty:
Had ſhe *ten thouſand Charms* in ſtore,
But wanted *One*, *in Money*,
I dare affirm, of all the ſcore,
Scarce *One* wou'd be ſo funny.

Mr. *Iſaac Tarrat* of *Epſom.*

A buckſome Widow ſure! of wond'rous Parts,
Thus to attract, or wound ſo many Hearts;
Widow! ſet up a School, inſtruct old Maids,
If this thou canſt, 'twill be the beſt of Trades.

Example 5.

At *Marbury* lately a Wedding has been,
One ſimilar to it, yet never was ſeen,
At Church when the Bridegroom & Bride did appear,
Crowds burſt out with laughter–that rumour led there.

To

To ſee this fine couple excited them much,
The Bridegroom deform'd,—with club feet & a crutch!
Came hopping along, and his Bride in full view
A buckſome young Laſs, of a delicate hue!
While linking,—the Parſon his Clark then did call,
To hold up the Bridegroom, for fear he ſhou'd fall.
The rites being over,—he halted away,
The bells they did ring, and the village was gay,
The Name of the Bridegroom may quickly be told,
If what you ſee under * vouchſafe to unfold.

The Name is compoſed of 5 Letters, as under.

the { 2d / 4th } Letters' place in the Alphabet is { 1/4 / 1/7 } of the 1ſt Letters' { place *leſs* 1 / place }

the { 3d / 5th } Letters' place in the Alphabet is { the / the } Sum of the { 4th / 2d } and { 5th / 4th } Letters' places

and the Sum of all the 5 Letters places is 48.

Suppoſe the firſt Letter's place to be 7 then (*per* Q.) 7. + 1.5 + 3.5 + 1 + 2.5 = 15.5 but ought to be 48, therefore 48—15.5 = 32.5 the firſt Error, and is in *Defect*.

Again, Suppoſe the firſt Letter's place to be 14 then (*per* Qu.) 14 + 3.25 + 7.25 + 2 + 5.25 = 31.75 but ought to be 48, therefore 48—31.75 = 16.25 is the other Error, and is alſo in *Defect*. Whence according to the *Rule* in *page* 432,

7 14

From 14 / Take 7 } × { 32.5 / 16.25 } = { 455 / 113.75 }

and the *Difference* of the Products will be 341.25 which divide by 16.25, the *Difference* of the Errors, and the Quotient will be 21 the place of the firſt Letter.

32.5 16.25 (21

Now

Now as the 1ſt Letters' place is 21

$$\text{the}\begin{cases}2\text{d}\\3\text{d}\\4\text{th}\end{cases}\text{and the 5th}\Big\}\ \text{Letter's place must be}\begin{cases}\frac{1}{4}\text{ of }21-1\\8+3\\\frac{1}{7}\text{ of }21\\5+3\end{cases}=\begin{cases}5\\11\\3\\8\end{cases}\text{viz.}\begin{cases}W\\E\\L\\C\\H\end{cases}$$

The Sum of all the Letters places is 48 which ſhew the Bridegroom's Name to be *W E L C H.*

And here I would obſerve to the Learner, that the *Rule of Poſition* will not bring out true Anſwers when the Numbers ſought aſcend above the firſt Power, for in that caſe (as Mr. *Hutton* juſtly remarks in his Arithmetic, *page* 140) the Reſults are not proportional with their Poſitions, nor the Errors with the difference of the true Number and each Poſition, yet in all ſuch caſes (as that *Gentleman* adds) it is a very good Approximation, and in exponential Equations, as well as many other things, ſucceeds better than perhaps any other method. And as the *Rule of Poſition* is ſo very uſeful in ſolving many intricate Problems, not only in *Arithmetic*, but alſo in *Algebra* and moſt parts of the *Mathematics*, therefore in order to obviate any difficulty that can poſſibly occur in this excellent *Rule of Poſition*, I ſhall give a Queſtion or two wherein the Method of Approximation will be ſhewn, and alſo that ſometimes Queſtions of that kind, *viz.* ſuch as cannot be ſolved by the *general Rule* in *Double Poſition*, may be transformed into others, reſolvable thereby, or by ſome of the more eaſy *Rules* of *Arithmetic*.

EXAM-

Example 6.

How old muſt a perſon be that if 22 be added to his Age, the Square Root of the Sum may be 8?

Suppoſe the Age to be 14 then (*per* Q.) 14+22=36, the Square Root whereof is 6, which ſhou'd have been 8, therefore 8—6=2 is the firſt Error and is in *Defect*.

Again, Suppoſe the Age to be 59 then (*per* Qu.) 59+22=81, the Square Root whereof is 9, which ſhou'd have been but 8, therefore 9—8=1 is the other Error but is in *Exceſs*. Now as the Errors are of *different kinds* therefore agreeable to the *Rule* in *page* 432,

14 59

To 14×1= 14

Add 59×2=118

and the *Sum* of the Prods. will be 132 which divide by 3 the *Sum* of the Errors, and the Quotient will be 44, which will not (for the Reaſon given in *page* 444) anſwer the Conditions of the Queſtion, for upon trial (according thereto) will be found to have an Error of .12 in *Exceſs*. Now in order to approach nearer to the Anſwer, proceed with this Error and the Number that produc'd it, along with either of the preceding Suppoſitions ſuppoſe the firſt and its Error, according to the *Rule* in *page* 432, *viz.* as the Errors are of a *different kind*, therefore

(44

2 1

44 14

To 44 × 2 = 88

Add 14 × .12 = 1.68

and the *Sum* of the Products will be 89.68 which divide by 2.12 the *Sum* of the Errors, and the Quotient will be 42.3

(42.3

.12 2

which alſo will not (for the Reaſon given in *page* 444) anſwer the Conditions of the Queſtion, but will be *very near* doing ſo, for upon trial it will be found to produce ſo ſmall an Error as .0187 which being ſo ſmall in *Exceſs* makes it plain that the Number 42.3 is but a little too much, and therefore without proceeding any further, there is great reaſon to believe that 42 is the Number ſought, but in order to become more certain thereof without trying it by the Queſtion, and to ſhew the learner that the further we proceed the nearer we ſhall get to the Anſwer, let us proceed with the Error .0187 and the Number that produc'd it, along with the preceding Number found *viz.* 44 and its Error, according to the *Rule* in *page* 432 *viz.* the Errors being of the *ſame kind*, therefore

42.3 44

From 42.3 × .12 = 5.076 X (42 nearly

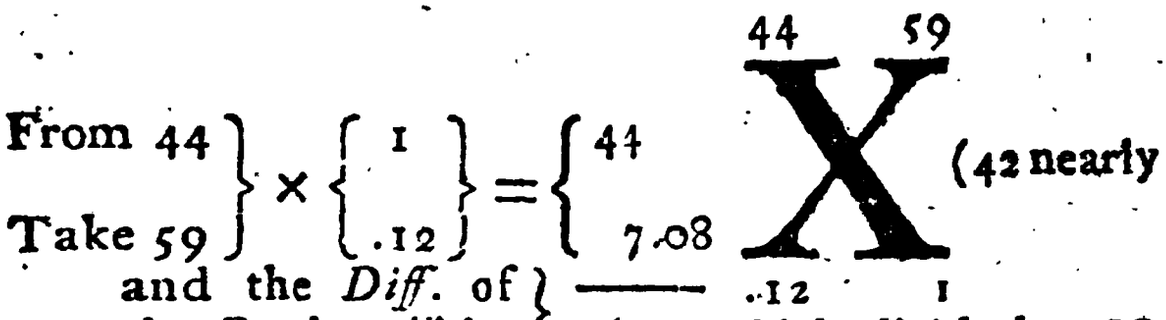
Take 44 × .0187 = .8228

and the *Diff.* of the Prods. will be 4.2532 ——— .0187 .12

which divide by .1013 the *Difference* of the Errors, and the Quotient will be *nearly* 42 and which will anſwer the Conditions of the Queſtion, conſequently 42 is the Age required.

But here it may not be amiſs to obſerve that in theſe kind of Queſtions where the Number ſought aſcends above the firſt Power it is beſt to uſe thoſe Suppoſitions that are the *leaſt erroneous*, for if inſtead of the Suppoſition 14 in the ſecond Operation, the Suppoſition 59 had been uſed it having the leaſt Error of thoſe two Suppoſitions, conſequently it is nearer the Number ſought, and therefore by working with it (along with the Suppoſition 44) the Anſwer will be ſooner approximated than as above, as appears by the following Operation.

From



and the *Diff.* of the Prods. will be 36.92 which divide by .88 the *Difference* of the Errors, and the Quotient will be *nearly* 42 the Anſwer, the ſame as before.

But this Queſtion may be far more eaſily ſolv'd than by the preceding method of Approximation, for it is plain before the Square Root is extracted (ſee the Queſtion *page* 445) the Sum muſt be equal to the Square of 8 *viz.* 64. Whence the Queſtion is eaſily transformed to this *viz.* What Number is that, to which if 22 be added the Sum may be 64 ?—The Anſwer to this Queſtion and conſequently to that in *page* 445 (the Anſwer to the one being the Anſwer to the other) will by the *Rule* in *page* 432, or by the *Corollary* in *page* 435, be eaſily found to be 42 the ſame as above.

But the Queſtion being transform'd as above is become ſo ſimple and eaſy, that it may be ſolv'd by *Subtraction* only, for from 64 take 22 and the Remainder will be 42 the Anſwer, the ſame as before.

Example 7.

What Number is that which multiplied by $\frac{1}{9}$ of itſelf, the Product may be 81 ?

It is plain from what is ſaid in *page* 444 and from the nature of the Queſtion that an *exact* Anſwer thereto cannot be obtained by the *Rule of Poſition*, but that (after the manner of the preceding Queſtion) it may be approximated to any deſired degree of exactneſs, but the Anſwer may be more eaſily found out

by transforming the Queſtion, for it is manifeſt that $\frac{1}{9}$ of the Square of the Number ſought muſt be 81, therefore the Number ſought muſt be the Square Root of the Anſwer to the following Queſtion *viz.* What Number is that which being divided by 9 the Quotient may be 81? the Anſwer thereto will by *Single Poſition* be eaſily found to be 729; or by *Multiplication* only, for $81 \times 9 = 729$ which is the Square of the Number ſought, and conſequently the Square Root of 729 *viz.* 27 muſt be the Number ſought or required.

Example 8.

Young *Hodge* a homely Country Swain,
Long courted *Suſan* of the Plain,
But never cou'd a method find,
To bring the Fair-One to be kind.
Her pride is center'd in herſelf,
She calls him Clown and Country Elf,
And mimicks faſhion with an air,
For dreſſing few with her compare.
This Charmer's Name with eaſe you'll find,
From what is underneath ſubjoin'd, *
O! tell the way to make her kind.

* This Maiden's Name is compoſed of 3 Letters, as under.

the { 2d / 3d } Letter's place in the Alphabet is the { Sum of the Squares of the 1ſt and 3d Letters' Places *more* / 1ſt Letter's Place *leſs* } 1

and the Sum of all the 3 Letters' Places is 19.

Suppoſe 4 to { wou'd be the { 1ſt / 2d / 3d } Letter's Place.

Then (*per* Q.) $4^2 + 4 - 1^2 + 1 = 26$
and $4 - 1 = 3$

The Sum whereof is 33 which ſhou'd have been but 19, therefore $33 - 19 = 14$ is the firſt Error, and in *Exceſs*.

Again,

Again, Suppoſe 6 to } be the { 1ſt / 2d / 3d } Letters Place.

Then (*per* Q.) $6^3+\overline{6-1}^2+1=62$ } would
and $6-1=5$ }

The Sum whereof is 73 which ſhou'd have been only 19, therefore $73-19=54$ is the other Error, and is alſo in *Exceſs*. Now as the Errors are of the *ſame kind*, therefore according to the *Rule* in *page* 432,

From 4		54	216	
Take 6	×	14	= 84	
and the *Diff.* of the Prods. will be			132	which divide by 40 the

4 6

X

24 54

Difference of the Errors, and the Quotient will be 3.3

Now as the Places of the Letters in the Alphabet cannot but be whole Numbers, therefore the above-mentioned Quotient 3.3 ought to have been a whole number only, wherefore it ſeems very likely that the firſt Letter's place of the name ſought, muſt be either 3 or 4, and upon trial 3 will be found to Anſwer the conditions of the Queſtion, for the firſt Letter's place being 3, the ſecond Letter's place (by the Queſtion) will be $3^2+\overline{3-1}^2+1=14$ and the third Letter's place will be $3-1=2$, the ſum of which three places is 19 agreeing with the Queſtion. And now

the { 1ſt / 2d } Letter's place being found to be { 3 / 14 } therefore that Letter muſt be { *S* / *U* }

and the 3d Letter's place being found to be 2 therefore that Letter muſt be *B*

Whence *SUSAN COB* is the Maiden's Name.

Note. This Queſtion I propos'd in the *Ladies Diary* for 1771 with *Algebraical Equations*, which was an-

ſwered by Mr. *Henry Clark*, under whoſe Solution Mr. *Thomas Adcock* writes in advice to *Roger*, thus,

Friend *Hodge* forbear to ſigh or ſob
For ſuch a one as *SUSAN COB*,
Addreſs ſome other charming ſhe,
That is more complaiſant and free.
This method take; perhaps you'll find
The *haughty Fair* will grow more kind.

SCHOLIUM.

The greateſt part of theſe Queſtions or Examples in *Single* and *Double Poſition* I publiſhed with *high Algebraical Equations* or *Fluxionary Expreſſions*, in the *Magazines* and *annual Publications*, (but in order to confine 'em to theſe *Rules of Poſition*, I have been obliged to make ſome alterations therein) and as they are moſt of 'em in verſe, I hope they will be thought an agreeable amuſement, as well as a proper exerciſe for my ingenious readers of both ſexes, and had not this Treatiſe been run to ſuch a great length, I wou'd have given a great many more of theſe delightful Queſtions, but muſt omit 'em in order to make room for the following Promiſcuous Queſtions, and to ſhew the method of finding the *leaſt Common Multiple* of any propoſed Numbers (a thing ſo very curious as well as uſeful) and alſo for *a copious Collection of new Queſtions* to exerciſe all the Rules in this Treatiſe, and for a few *Arithmetical Paradoxes* for the amuſement and exerciſe of youth.

PROMISCUOUS QUESTIONS.

Queſtion 1. by Miſs *Ann Nicholls*.

Ladies Diary 1761.

Old *John* who had in credit liv'd,
Tho' now *reduc'd*, a *Sum* receiv'd:
This lucky *Hit*'s no ſooner found,
Than clam'rous *Duns* come ſwarming round:

To

To th' *Landlord*,—*Baker*,—many more,
John paid in all, Pounds ninety-four.
Half what remain'd—a friend he lent—
On *Joan* and *Self*, one fifth he spent;
And when of all these Sums bereft,
One tenth o'th *Sum receiv'd* had left,
—Now shew your skill ye learned Fair,
And to the world that *Sum* declare.

Suppose the Sum receiv'd £98 then (*per* Question) 94+2+.8=96.8, and 98−96.8=1.2 which according to the Supposition ought to have been $\frac{1}{10}$ of 98 *viz.* 9.8 therefore 9.8—1.2=8.6 is the first Error, and is in *Defect*.

Again, Suppose the Sum receiv'd was £150 then (*per* Qu.) 94+28+11.2=133.2. and 150—133.2=16.8 which according to the Supposition ought to have been but $\frac{1}{10}$ of 150 *viz.* 15, therefore 16.8—15 =1.8 is the other Error, but is in *Excess*. Now the Errors being of *different kinds* or *affections*, therefore according to the *Rule* in *page* 432,

98 150

To 98 } × { 1.8 } = { 176.4
Add 150 } { 8.6 } = { 1290

and the Sum of the Prods. will be 1466.4 which divide by 10.4 the *Sum* of the Errors, and the Quotient will be £141 the Answer.

(141
X
8.6 1.8

Or, according to the *Corollary* in *page* 435, As 10.4 the *Sum* of the Errors (because they are of a *different kind*) is to 52 the Difference of the Suppositions, so is 1.8 the least Error, to 9 the Correction of the Supposition 150, which *subtract* therefrom (because the Errors

Errors are of a *different kind*, and the Suppoſition belonging to the leaſt Error is *greater* than the other Suppoſition, ſee the beforementioned *Corollary*) and the *Remainder* will be £141 the Anſwer, the ſame as before.

Queſtion 2. by Miſs *Padmore*.

From *Palladium* for 1762.

How *Bride* and *Bridegroom*'s Ages diſagree,
The following *Caſe* reſolv'd will let you ſee.
Nine times the *Huſband*'s Age, as late appear'd,
Was equal to the *Lady*'s Age when ſquar'd.
Take twice *her* Age from *his*, and you will find,
That juſt ſixteen will then remain behind.

Suppoſe 81 to be the { *Huſband's* / *Wife's* } Age.

Then (*per* Qu.) $\sqrt{81 \times 9} = 27$ wou'd be the { *Huſband's* / *Wife's* } Age.

and $81 - 27 \times 2 = 27$ which (by the Queſtion) ſhou'd have been only 16, therefore $27 - 16 = 11$ is the firſt Error, and is in *Exceſs*.

Again, Suppoſe 100 to be the { *Huſband's* / *Wife's* } Age.

Then (*per* Q.) $\sqrt{100 \times 9} = 30$ wou'd be the { *Huſband's* / *Wife's* } Age.

and $100 - 30 \times 2 = 40$ which (by the Queſt.) ſhou'd have been only 16, therefore $40 - 16 = 24$ is the other Error, which is alſo in *Exceſs*. Now the Errors being of the *ſame kind*, therefore according to the *Rule* in *page* 432,

81 100

From 81 } × { 24 } = { 1944
Take 100 } × { 11 } = { 1100

(64.92

11 24

and the *Difference* of the Products will be 844 which divide by 13, the *Difference* of the Errors, and the Qpotient will be

be 64.92, which will not (for the Reaſon given in *page* 444) anſwer the Conditions of the Queſtion, but upon trial (according thereto) will be found to have an Error of .58 in *Exceſs*, which being ſo ſmall gives great reaſon to believe that 64 muſt be the Number ſought, but in order to be more certain thereof, without trying it by the Queſtion, let us proceed with the Error .58 and the Number that produc'd it, along with the preceding Suppoſition 81 and its Error, according to the *Rule* in *page* 432, *viz.* as the Errors are of the *ſame kind*, therefore 64.92 81

From 64.92 } × { 11 } = { 714.12 } X (64.02
Take 81 } { .58 } { 46.98 }

and the *Diff.* of } —— .58 11
the Prods. will be } 667.14 which divide by 10.42 the *Difference* of the Errors, and the Quotient will be 64.02, which likewiſe will not (for the Reaſon given in *page* 444) anſwer the Conditions of the Queſtion, but as the other Number found, *viz.* 64.92 produc'd ſo ſmall an Error as .58, and ſince it is plain that the further we proceed the nearer we approach to the Anſwer, conſequently the Number laſt found *viz.* 64.02 muſt be *very near* the Number ſought, wherefore it is very likely that 64 is the *Huſband's* Age, and which upon trial will be found to be ſo, for 64 being } accounted the { *Huſb's* / *Wife's* } Age.

Then (*p.* Qu.) $\sqrt{64 \times 9} = 24$ muſt be and which two Numbers anſwering the Conditions of the Queſtion prove the reſpective Ages as above.

Note. Under ſeveral *Algebraical Solutions* to this Queſtion (by Mr. *Pinnington*, Mr. *Antrobus*, and Mr *Johnſon*, in Palladium 1763.) Mr. *John Budale* humourouſly writes thus:

" What can old *Froſty* do with ſuch a Wife?
" Youth tied to Age, palls all the Joys of Life."

To find leaſt COMMON MULTIPLES, &c.

SCHOLIUM.

HAVING now treated very copiouſly on the *Rules of Poſition*, and as in thoſe *Rules* it is often very neceſſary (in order to avoid Fractions) to ſuppoſe ſuch Number or Numbers as being divided by given Diviſors ſhall leave no Remainder, therefore, and in order to ſhew how to ſolve many curious and pleaſant Queſtions, which are not reducible to any of the preceding *Rules*, and conſequently to make this Treatiſe as complete as poſſible, I ſhall now ſhew how to find the *Leaſt Common Multiple* of any propoſed Numbers, *i. e.* to find the leaſt Number which may be divided by any Number of given Diviſors, without leaving any Remainder, and to do which obſerve the following

RULE.

All equal Numbers—as you'll ſee,—
Except one may rejected be,
Such as are al'quot parts I ſay
Of any o'th' others, likewiſe may
Rejected be—and when you find
That any propoſed Number—mind—
Is an al'quot part o'th' *Product*, ſee
Of any o'th' Numbers, two or three,
It likewiſe may rejected be.—
The Common Multiple * of two
Of any o'th' given Numbers, you

* Common Multiple is the Common Product of any two or more propoſed Numbers, and conſequently may be meaſured, *i. e.* divided by any of the Numbers of which it is compoſed without leaving any Remainder, and the Quotient will be the Product of all the other Numbers.

Muſt

Muſt true divide by what you ſee,
Their greateſt Common Meaſure'll be,
The Quote's the *leaſt Common Multiple.*
If any Number not us'd, is
An al'quot part—beſure mind this—
Of the *leaſt Common Multiple*
Laſt found,—ſuch may rejected be.
—The *leaſt Common Multiple* find
Of that before found, *Tyro* mind—
And any o'th' given Numbers, too
Not us'd.—In the ſame way purſue
With each new *leaſt Common Multiple*
'Till all the propoſed Numbers be
Conſider'd, and the *laſt* you'll find,
Will be the *Leaſt* juſt to your mind.

Note. It is plain from the *Rule* that when Numbers are *prime* to each other, *viz.* When they have no other Common Meaſure than Unity, *i. e.* when no Number but Unity will meaſure both, their *Common Multiple* or *Product* is their *leaſt Common Multiple.* —A *Prime Number* is ſuch as can be meaſured only by Unity and a Number equal to itſelf, and conſequently cannot be produced by the Multiplication of any Number of Integers.

Example I.

Quere, the leaſt whole Numbers that can be divided by the 9 Digits ſeverally, and leave no Remainder? *Or* which is the ſame thing, What is their leaſt Common Multiple?

The given Diviſors being 1, 2, 3, 4, 5, 6, 7, 8 and 9 it is plain that $1\times2\times3\times4\times5\times6\times7\times8\times9=362880$ is the Common Multiple and may be divided by the 9 Digits and leave no Remainder, but in order to obtain the *leaſt Common Multiple* or Number that will do ſo, the Numbers 1, 2, 3 and 4 may (according to the *Rule*) be rejected, they being aliquot parts of ſome

of

of the others, and as 5, 6 and 7 are *prime* to one another, therefore $5\times6\times7=210$ is the *leaſt Common Multiple* of thoſe 3 Numbers, then multiply 210 by 8 and divide the Product or Common Multiple 1680 by 2 the greateſt Common Meaſure of 210 and 8, and the Quotient will be 840 the *leaſt Common Multiple* of thoſe 2 Numbers, and laſtly multiply 840 by 9 and divide 7560 the Product or Common Multiple by 3 the greateſt Common Meaſure of 840 and 9, and the Quotient will be 2520 the *leaſt Common Multiple* or *Number* required.

Example 2.

What is the leaſt Common Multiple of 45, 21, 85, 7, 35 and 23?

Multiply 45 by 21 and divide their Common Multiple or Product 945 by 3 their greateſt Common Meaſure, and the Quotient will be 315, which multiply by 85 and divide the Common Multiple or Product 26775 by 5 the greateſt Common Meaſure of 315 and 85, and the Quotient will be 5355, and as 7 (the next propoſed Number) is an aliquot part of 21 (one of the preceding ones) and alſo 35 (the next propoſed Number) an aliquot part of 5355, therefore (according to the *Rule*) thoſe 2 Numbers 7 and 35 may be rejected, then 5355 and the remaining propoſed Number 23 being *prime* to each other, therefore $5355\times23=123165$ is the *leaſt Common Multiple* or *Number* required.

And here it may not be improper juſt to mention, that there are other methods of finding the *leaſt Common Multiple*; but as that which I have here given is ſo plain and eaſy, and this Book far above the ſize it was firſt intended to be, I ſhall therefore ſay nothing about 'em, but only juſt obſerve that oftentimes a good

good deal of trouble may be ſaved, if inſtead of dividing the Common Multiple or Product of the two Numbers by their greateſt Common Meaſure, you divide the leaſt of the two Numbers by ſuch Common Meaſure, and multiply the other Number by the Quotient, but this being ſo plain and eaſy that it wou'd be quite needleſs to ſay any thing more about it.

Example 3.

Tom the Gardener counting ſome Apples into a Baſket, found that when he counted them in by two at a time, three at a time, and four at a time, there remained one, but when he counted 'em in by five at a time there remained none. *Quere* the Number of Apples?

The *leaſt Common Multiple* of the Numbers 2, 3, and 4 is eaſily found to be 12, to which add 1 and the Sum will be 13, which divided by three of the given Numbers, *viz.* 2, 3 and 4, will leave 1 according to the Queſtion, but divided by 5 will leave 3, which being 2 ſhort of 5, therefore to twice 12 add 1 and the Sum will be 25, the Number required.

Example 4.

Required the leaſt Number which being divided by 7, 6, 5, 4, 3 and 2, ſhall leave 6, 5, 4, 3, 2 and 1 reſpectively?

The *leaſt Common Multiple* of the given Diviſors 7, 6, 5, 4, 3 and 2 will be eaſily found (by the *Rule*) to be 420, and which is the leaſt Number that can be divided by the given Diviſors without leaving any Remainder, therefore from 420 deduct 1 and the Remainder will be 419 the Anſwer.

Example 5.

Required the leaſt Number that will anſwer the following Conditions, *viz.* when divided by 8 ſhall leave 4 for a Remainder, when divided by 7 ſhall leave 3, and when divided by 6 ſhall leave 2, and ſo on leaving each time 4 for a Remainder leſs than the Diviſor, till divided by 4, nothing ſhall remain?

The *leaſt Common Multiple* of the given Diviſors 8, 7, 6, 5 and 4 will (by the *Rule*) be eaſily found to be 840, which being the leaſt Number that can be divided by thoſe Diviſors without leaving any Remainder, therefore from 840 deduct 4 and the Remainder will be 836 the Number required.

Example 6.

Quere the four leaſt Numbers that will anſwer the following conditions, *viz.* when divided ſeverally by 12 ſhall each leave 11 for a Remainder, when divided ſeverally by 11 ſhall each leave 10, and ſo on, always leaving one leſs than the Diviſor, to Unity?

The *leaſt Common Multiple* of the given Diviſors 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2 and 1 will be eaſily found (by the *Rule*) to be 27720 which multiply ſeverally by 2, 3 and 4 and the Products will be 55440, 83160 and 110880, which ſeveral Numbers, *viz.* 27720, 55440, 83160 and 110880 are the four leaſt Numbers that can be divided by the given Diviſors without leaving any Remainder, from which ſeveral Numbers deduct Unity and the Remainders will be 27719, 55439, 83159 and 110879 the four leaſt Numbers required.

And now having ſhewn how to find the *leaſt Common Multiple* of any propoſed Numbers, it may not be amiſs juſt to obſerve that it is of excellent uſe *in reducing*

reducing Fractions to their leaſt Common Denominator, and is the *Ground* and *Explanation* of the former part of the *Note* to *Caſe* 9 in *page* 251, for it is plain, that the *leaſt Common Multiple* of the Denominators is always the *leaſt Common Denominator* that the Fractions can be reduced to, and in order to find the new Numerators thereto, divide the ſeveral Products ariſing from the *leaſt Common Denominator* being multiplied into each Numerator, by the reſpective Denominators, and the ſeveral Quotients will be the new Numerators required. *Or*, the *leaſt Common Denominator* divided by each Denominator ſeparately, and the Quotients multiplied by their reſpective Numerators will alſo produce the new Numerators required, but this being ſo plain and eaſy I ſhall in this place ſay no more in relation thereto, but proceed to the next thing propoſed, namely

A COLLECTION of NEW QUESTIONS

to exerciſe all the Rules in this Treatiſe.

1. IN the *Old* and *New Teſtament*, tell unto me
What Number of Chapters contained there be?

Anſwer, 1189.

2. *John* borrow'd of his Friend ſome caſh
In part he ſoon paid down
Twelve golden Guineas,—ſtill unpaid
A Noble and a Crown.
What did he borrow tell me true
In royal *Britiſh* Coin?
This *Tyro* you may quickly do,
To make your learning ſhine:

Anſwer, £ 13 s 3 d 8.

3. Suppoſe *Thomas* and *Harry* buy a Piece of Timber containing 104 ſolid Feet, and that *Harry* is to have 67 Feet. *Quere Thomas*'s Share?

Anſwer, 37 Feet.

4. Suppoſe a Tradeſman be indebted to *A* £147 16*s* 11*d*, to *B* £400 15*s* 7$d\frac{1}{2}$, to *C* £340 19 4$d\frac{3}{4}$, to *D* £64 15*s* and to *E* £500, and that towards the Payment of theſe Debts, he has in Caſh, £145, in Shop-goods £164 18*s* 4*d*, in Houſhold Furniture £210 14*s* 10*d*, in a Tenement 40 Guineas and a Mark, and in recoverable Book-Debts £100 15*s* 4$d\frac{1}{2}$. Now if theſe things be delivered to his Creditors, what wou'd they then loſe by him?

Anſwer, £ 790 s 5 d $-\frac{3}{4}$.

5. Suppoſe a Perſon die and leave his two Sons *A* and *B* to pay a certain Debt equally, out of their reſpective Fortunes, and that *A* has paid £60 11*s* 4$d\frac{1}{2}$, toward ſuch Debt, and *B* £40 16*s* 10*d*, and that there ſtill remains due £20 14*s* 6$d\frac{1}{2}$. *Quere*, What has each yet to pay (as they muſt pay equally) of the aboyementioned Debt, and what was the Debt the Father left 'em to pay?

Anſwer, *A*, *B* muſt pay £ — 10 —, 20 4 6$\frac{1}{2}$
and the whole Debt was £122 2*s* 9*d*.

6. What Number taken from 12 times 64, will leave 15 times 24?

Anſwer, 408.

7. Miſs *Nancy* ſaid—*Mamma* I find
Your Age is thirty-two,
And I juſt fourteen to my mind,
This you'll allow is true:

What

What will our Ages be declare,
When I am half as old
As you *Mamma?* 'tis very fair
The Queſtion ſhou'd be told.

Anſwer, 36 and 18.

8. Suppoſe a Farmer ſell the following quantity of Corn, *viz.*

140		Wheat		7 3
60	Buſhels of	Rye	at	4 2
346		Oats		2 $9\frac{1}{2}$
and 270		Barley		3 $6\frac{1}{2}$

s d

per Buſh.

What does the whole Quantity amount to?

£ s d

Anſwer, 159 7 2.

9. What Number multiplied by 1234 will produce 64168?

Anſwer, 52.

10. Suppoſe a Sawyer having meaſured a certain Number of Boards found them to contain 3400 Square Feet. How many Roods (of 400 Feet to the Rood) are contained therein?

Anſwer, $8\frac{1}{2}$ Roods.

11. Admit a Gentleman wou'd divide 600 Acres of Land amongſt his three Sons *A*, *B* and *C*, in ſuch manner that *A* and *B* muſt have 68 or 50 Acres more than *B* or *C*

What Quantity of the (600 Acres) muſt each have?

Anſwer, *A*, *B* and *C* muſt have 262, 194, 144 Acres.

12. Suppoſe a Gentleman to have 3840 Fruit Trees, in five different Nurſeries, and the greateſt Nurſery to exceed

the { 2d, 3d, 4th, } by { 64, 146, 280, } and the 5th, } by { 310 } Trees,

Quere, the Number of Trees in each Nurſery?

Anſwer, 928, 864, 782, 648 and 618 Trees.

13. Suppoſe Miſs *Charlotte*'s and Miſs *Fanny*'s Fortunes added together make £1000, and that if you deduct the leſs Sum *viz.* *Fanny*'s from the other, the remainder wou'd be £76 10*s* –*d* ½. *Quere*, the reſpective Fortunes?

		£	*s*	*d*
Anſwer, *Charlotte*'s and *Fanny*'s	Fortune	538	5	— ¼
		461	14	11 ¾.

14. Suppoſe *Job*, *Ralph*, *George* and *Thomas* have a Prize of £6489, and agree to divide it in ſuch manner that as oft as

Job, *Ralph*, *George* and *Thomas* } takes { a Crown, half a Crown, a Shilling, Sixpence,

Quere, each man's Share according to the abovementioned agreement?

		£	*s*
Anſwer, *Job*'s	Share is	3605	—
Ralph's		1802	10
George's		721	—
and *Thomas*'s		360	10.

15. If 4 Hogſheads of ſtrong Beer were to be bottled off into Quart Bottles. How many Dozen wou'd they fill? *Anſwer*, 68 Dozen.

16. In

16. In 340 Ducatoons at 6*s* 4*d* each. How many Florins at 3*s* 2*d* each? *Anſwer*, 680 Florins.

17. How many Caniſters of Tea each holding 16 ℔ can be filled out of 11C. 1qr. 20 ℔?

Anſwer, 80 Caniſters.

18. If 3C. 1qr. 24 ℔ of Currants coſt £6 17*s* 5*d*. How were they ſold *per* ℔ when the Profit ariſing thereby came to £1 4*s* 3*d*? *Anſwer*, 5*d*.

19. Suppoſe I bought two hundred Eggs,
One half at five a penny,
The other half but four * I had,
I cou'd not get ſo many.
T' oblige a Neighbour after, I
Diſpoſe of all this Ware,
And nothing for my Profit get,
How were they ſold † declare?

* a penny.

† *i. e.* how many Eggs a penny.

Anſwer, 4 $\frac{4}{9}$ *viz.* 4 $\frac{1}{2}$ *nearly*.

20. Suppoſe a Shepherd buys 200 Sheep for £85 and after ſometime ſells them again for £105. Now ſuppoſe they had coſt him at firſt £105. What muſt they be ſold for to gain after the ſame Rate?

£ *s* *d*

Anſwer, 129 14 1 $\frac{3}{4}$ $\frac{11}{17}$.

21. Sound being found by Experiment to move 1142 Feet in 1 Second of Time, *Quere*, How long after the firing of a Cannon at *Cheſter*, may the report be heard at *Whitchurch*, diſtant 20 Miles?

Anſwer, 1 *Minute* 32 $\frac{268}{571}$ *Seconds*.

22. Admit on any certain Day at 8 o'Clock in the Morning a perſon ſets out from *Whitchurch* to *London* which is 162 Miles, and goes at the rate of 2 $\frac{1}{2}$ Miles *per* Hour, and that another perſon ſets out from *London* for *Whitchurch* at 3 o'Clock in the Evening of the

the ſame Day, and comes down at the Rate of 3 Miles an Hour. *Quere*, How far diſtant between *London* and *Whitchurch* wou'd they meet?

Miles		*Mls.*	*Fur.*	*Pls.*	*Yds.*		
Anſ. 78 $\frac{9}{11}$	=	78	6	21	4 $\frac{4}{11}$	from	*London*
and 83 $\frac{2}{11}$	=	83	1	18	1	from	*Whitch.*

23. *A* working alone in twelve Days can compleat
The making a Veſſel of Copper quite neat,
Which wou'd take ſixteen Days to be made up by *B*,
He working more ſlowly than *A* you may ſee.
Now working together, what Time will they take
Before the ſaid Veſſel compleatly they'll make?

Anſwer, 6 $\frac{6}{7}$ Days.

24. Suppoſe a Gentleman having an Eſtate of £200 *per Annum* wou'd divide the ſame into two Farms, ſo as to be in proportion to each other as 3 to 5. *Quere*, the yearly Value of each?

Anſwer, £75 and £125.

25. Suppoſe a Garriſon conſiſting of 8000 Soldiers be beſieged and that they have Proviſions to ſerve 'em five Months. How many Men muſt depart therefrom in order that the Proviſions might ſerve the Remainder 8 months? *Anſwer*, 3000 Men.

26. *Jack Queer* a ſcold has to his ſpouſe,
Old *Xantippe* outvies,
She bangs him round about the houſe,
Makes a perpetual noiſe.
Dick Hog too, has a drunken wife,
Who much conſumes his ſtore,
And makes him an unhappy life,
Thinking he ſhall grow poor.
At landlord *Gill*'s, to have a whet
Of ale or beer they ſay,
Theſe two unhappy huſbands met,
Upon a certain day. Whilſt

Whilſt drinking their diſcourſe began
'Bout changing of their wives,
And as they toſs about the Can,
Dick wiping of his eyes.
Says *Jack* a bargain I will make,
But ſomething more ſhall crave,
Than juſt your wife becauſe you know
Mine's nearer to the grave,
Each age I find's as *two* to *three*,
Their ſum *one hundred years*,
So boot in hand, dear *Dick* muſt be,
As plainly now appears.
Says *Dick* to *Jack* I'll give to you
T'bacco as many pound,
As your wife's age exceedeth mine,
So let the Can go round.
The bargain's ſtruck—each age unfold,
And what the whole comes to
Of the tobacco at the price
You in the margin view.

	d
*	14½ *per* lb

Anſwer, *Jack's* } Wife's Age { 60 } Years,
Dick's } { 40 }
and the price of the 20lb of tobacco £1 4s 2d.

27. Suppoſe a Regiment of Soldiers conſiſting of 800 men are to be new clothed and that each man's coat will take 2¾ Yards, of yard and half wide Cloth. How many Yards of ſhalloon of three quarters wide will line the ſame? *Anſwer*, 4400 Yards.

28. Suppoſe a round Ball weighing 1½ lb be impelled by ſuch a force as to make it fly 380 Feet in one ſecond of time. With what velocity wou'd a Bullet of ¼ lb weight move, if impelled by the ſame force? *Anſwer*, 2280 Feet.

29 Admit a Ciſtern holding 140 Gallons be ſupplied by a pipe with water at the rate of 48 gallons an

hour. In what time (ſuppoſing the influx and efflux of the water to be always alike) wou'd the Ciſtern be fill'd if both the pipes were ſet open at once ?

Anſwer, 10 Hours.

30. If a clock having two hands turning upon the ſame center or axis, be obſerved to have the following Motion *viz.*

the flower } Hand to move { 3 } Rounds in { $2\frac{1}{2}$ } Hours.
and the ſwifter } { $2\frac{1}{4}$ } { 2 }

Quere, the Synodical Period of the two Hands (*i. e.* the time they would take in getting together again from their ſetting out together at one and the ſame place) and how many Revolutions wou'd each Hand make in ſuch Period ?

Anſwer, Synodical Period 20 Hours, in which time the flower hand wou'd make 24 Revolutions and conſequently the other 25.

31 If 8 Cows or 11 Heifers wou'd eat a field of Graſs in 108 Days, In what time (after the ſame rate of eating) wou'd 4 Cows and 5 Heifers eat the ſame ?

Anſwer, 113 $\frac{1}{7}$ Days.

32. Suppoſe twelve men ſix pounds in 8 days earn,
How many men muſt be you'll ſoon diſcern
To earn juſt fifty Guineas, and no more
In twenty days—This *Tyro* pray explore.

Anſwer, 42 Men.

33. If 10 men can build a boat in 20 days when the day is 14 hours long. In how many days (after the ſame rate of working) cou'd 18 men build the ſame when the day is 11 hours long ?

Anſwer, 14 $\frac{14}{99}$ Days.

34. In

34. In 8 Caſks of Tobacco each containing 8C. 1qr. and 24 ℔. Tare 3qrs. 20 ℔ *per* Caſk, Trett 4 ℔ *per* 104 ℔. and Cloff 3 ℔ for every 3C. Groſs. What does the Neat Weight come to at $8\frac{1}{4}d$ *per* ℔ ?

£ s d

Anſwer, 219 17 $9-\frac{6}{63}$.

35. If 6 Caſks of Oil weigh 20C. 1qr. 2 ℔ Groſs. How many Gallons, allowing 20 ℔ *per* C. Tare, and $7\frac{1}{2}$ lb. to the Gallon?

Anſwer, 248 $\frac{13}{17}$ Gallons.

36. Suppoſe a May-Pole be broke in two Parts, and that the ſtanding Part is $11\frac{1}{4}$ Feet more than $\frac{3}{4}$ } of { $\frac{5}{9}$ } of the whole.
and the other Part juſt $\frac{1}{2}$ } { $\frac{3}{4}$ }

Quere, the Length of the whole Pole, and alſo the Length of each Part?

Anſ. 54 } Feet, the Length of the { whole Pole,
$33\frac{3}{4}$ } { ſtanding } Part.
and $20\frac{1}{4}$ } { other }

37. Admit a Tower or Landmark be $\frac{1}{14}$ } in the { Ground
$\frac{1}{10}$ } { Water
and 116 Feet above the Water. *Quere*, the whole Height thereof? *Anſwer*, 140 Feet.

38. Admit 12 Gallons of Beer were drawn out of a Caſk after it had leaked away $\frac{1}{9}$ of the whole. What did the Caſk hold, when upon being guaged there remained undrawn $\frac{5}{9}$ of the whole Quantity?

Anſwer, 36 Gallons.

39. Once drunken *John* to th' Alehouſe went,
T' be fuddl'd was his whole intent,
One fifth o'th money in his purſe,
Spent at the *George* and to make worſe,
He reel'd away unto the *Bear*,
Three ninths of what he'd left ſpent there,

At

At laſt when to his ſenſes come,
He counts his caſh to know what Sum
Was left behind—which was no more
Than ten * and eight Pence; ſo explore
What Sum at firſt his Purſe had in
Ere this wild frolic did begin ?

* Shils.

Anſwer, 20 Shillings.

40. Suppoſe a Perſon dies and leaves the whole of his Eſtate amounting to £4060 to be divided amongſt his 6 Sons in the following manner, *viz.*

the { 2d, 3d, 4th, 5th } and the 6th } Son to have { $\frac{3}{4}$, $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{1}{2}$ } of the { Eldeſt, 4th, 5th } Son's ſhare

How much of the £4060 muſt each Son receive ?

		£	s	d
Anſwer, 1ſt	Son's Share	1459	15	$6-\frac{24}{89}$
2d		1094	16	$7\frac{1}{2}\frac{18}{89}$
3d		729	17	$9-\frac{12}{89}$
4th		364	18	$10\frac{1}{2}\frac{6}{89}$
5th		273	14	$1\frac{3}{4}\frac{4}{89}$
and the 6th		136	17	$-\frac{3}{4}\frac{6}{89}$

41. A *Roman Lawyer* as the ſtory goes,
A Queſtion of this kind did firſt propoſe,
That if a perſon die and leave behind
His whole Eſtate (th' Amount is here ſubjoin'd *)
And Wife with Child then 'tis his will and mind
If of a Son ſhe ſhou'd deliver'd be,
Two thirds muſt be his Share, one third for ſhe.
But if a Daughter, then the Widow's Share,
Muſt be two thirds, the Daughter's one 3d clear.

* £8000 *per Annum.*

Now

Now soon the Widow is, as we descry,
Deliver'd of a Daughter and a Boy.
T'answer the Father's Will, now tell to me
How th' 'state with Justice must divided be?

		£	s	d	
Ans. Son's	Share	4571	8	$6\frac{3}{4}\frac{3}{7}$	*per Ann.*
Mother's	Share	2285	14	$3\frac{1}{4}\frac{5}{7}$	*per Ann.*
and Daughter's	Share	1142	17	$1\frac{1}{2}\frac{6}{7}$	*per Ann.*

42. Old *Derby* bought a pretty House,
To live in at his Ease,
At the Desire of *Joan* his Spouse,
Whom he always strove t'please:
But Death soon snatch'd them both away,
To the *Elysian* Bow'r,
And *Derby* left his House they say
To *Hodge*, who blest the Hour
That Fortune had so smil'd upon
Him, now in time of need,
Because he had —— O! silly Man,
Spent all he had indeed.
And thro' Extravagance we find,
The House was quickly sold,
For just three fourths of what it cost,
O! shocking to be told.
His Debtors swarm about like Bees,
Three of them *A*, *B*, *C*,
Now will be paid or else to Goal,
They'll send him instantly.
And Landlord *Swilltub* does protest,
Unless he'll pay his Score,
For Ale and Liquor of the best,
He shan't have Freedom more,
But rot in Goal —— for ought he cares!
How hard-heart'd Landlords be!
Their tempting Baits and dainty Wares
Bring Men to Poverty.

Hodge being ſeiz'd, no more cou'd do,
But pay to Debtors three,
One third, two ninths, three fifteenths——ſo
He paid *A*, *B* and *C*.
One fifth to *Swilltub* likewiſe paid——
When of theſe Sums bereft,
Three Pounds ſix Shillings and eight Pence,
Was all that *Hodge* had left.
Still, ſtill perplex'd with clam'rous din,
For drabbling debts was he,
Till ev'ry Farthing's paid and gone——
Now *Tyro* tell to me,
What Caſh the Houſe was ſold for——too
What *Derby* paid likewiſe
For it——All this with Eaſe you'll do,
And to Mount Science riſe.

Anſwer, the Houſe was ſold for £75 and coſt £100.

Note. This Queſtion, *viz.* the 42d, is propoſed as a Caution to ſhun ill Company and Extravagance.

43. Now we'll ſuppoſe from th' Center of a Tow'r,
On level Ground one hundred Yards and four,
And from the bottom of this lofty Pile,
Unto the Top two eighthieths of a Mile.
A Rope from th' Top quite reaches to the Ground,
Whoſe Length in Yards may eaſily be found.
A Flyer on this Rope deſcends in ſight,
From th' Tower's Top he takes amazing Flight.
—This ſcaling Rope's true Length with eaſe you'll find,
From *Euclid*'s Rule * that's hereunto ſubjoin'd.

* In every right angled Triangle

the { *Sum* / *Diff.* } of the *Squares* of the { *Baſe* / *Hyp.* } and { *Perp* / *Baſe.* } is equal to the *Square* of the { *Hypoth.* / *Perp.* }
and the *Diff.* of the *Squares* of the { *Hyp.* / *Perp.* } and { *Perp* / *Baſe.* } is equal to the *Square* of the { *Hypoth.* / *Baſe.* }

Anſwer, 112.924 Yards, *viz.* 113 nearly.

44. Ad-

44. Admit the Height of a Caſtle Wall be 60 $\frac{1}{2}$ Yards, and a ſcaling Line drawn from the Top of the Wall to the further ſide of the Caſtle Ditch 200 $\frac{1}{4}$ Yards. *Quere* the Breadth of the Ditch?

Anſwer, 190.892 Yards.

45. Suppoſe the length of a ſcaling Ladder from the Ground to the top of an Edifice be 40 Feet, and from the foot of the Ladder to the bottom of the Edifice 30 Feet. What is the Altitude of the Edifice?

Anſwer, 26.457 Feet, or nearly 26 $\frac{1}{2}$.

46. Admit the height of a Mountain be 4 Miles above the ſurface of the Sea, and the Semidiameter of the Earth 3984.58 Miles. How far may the Mountain be ſeen at Sea, the eye of the ſpectator being ſuppoſed to be on the ſurface of the Water?

Anſwer, 178.585 Miles.

47. If a Pipe of a Cock whoſe Diameter is 2 Inches will fill a Ciſtern in half an Hour. What muſt the Diameter of another Pipe be to fill it in quarter of an Hour? *Anſwer*, 2.828 Inches.

48. Admit a Cubical Stone to contain 884736 ſolid Inches. How many Feet of Board wou'd cover the ſame? *Anſwer*, 384 Feet.

49. Suppoſe a Cellar be to be dug 20 $\frac{1}{2}$ Feet every way, *i. e.* in Length, Breadth and Depth. How many ſolid Feet of Earth muſt be digged up to complete the ſame? *Anſwer*, 8615.125 Feet = 8615 $\frac{1}{8}$ Feet.

50. If a Bullet whoſe Diameter is 3 $\frac{1}{2}$ Inches weigh 7 $\frac{1}{4}$ lb. What wou'd be the Diameter of another Bullet of the ſame metal weighing 40 $\frac{1}{2}$ lb?

Anſwer, 6.2102 Inches.

51. Suppoſe the ſides of two Cubes be 5 and 7 Inches. Required the ſide of another Cube that ſhall be equal in ſolidity to the two given Ones.

Anſ. 7.763936 *viz.* a little more than 7 $\frac{3}{4}$ Inches.

52. What is the Simple Intereſt of £540 8s 9d for 8 ¾ Years at £4 ⅛ *per Cent. per Annum?*

£ s d
Anſwer, 206 17 8 ½ 25/32.

53. If *A* ſhou'd mortgage his Eſtate,
For a thouſand Pounds t' *B*,
Allowing Int'reſt at the Rate
You in the Margin * ſee
And that th' Sum remain'd to *B*'s mind,
Nine Years nine Months not more,
Before *A* cou'd a method find,
To pay him off his ſcore.
Then tell to me the whole Amount,
That *A* muſt pay to *B?*
Haſte *Tyro*, haſte, begin to count,
You'll do it inſtantly.

* £4 ¾ *per Cent. per Annum* Simple Intereſt.

£ s d
Anſwer, 1463 2 6.

54. At what Rate of Simple Int. will £432 5s 10d amount to £560 10s 5½d in 6 Years and 216 Days?

Anſwer, £4 ½ *per Cent.*

55. Admit a perſon lent 100 Guineas at £5 *per Cent. per Annum*, Simple Intereſt, and on the firſt day of *June* 1773, receiv'd £1 6s 3d for every Guinea. When muſt the Money have been lent?

Anſwer, On the firſt day of *June*, 1768.

56. Suppoſe a perſon (on one and the ſame day) puts out £200 at £4½ *per Cent. per Annum*, and £260 at £3 *per Cent. per Annum*. In what time at Simple Intereſt wou'd they exactly have the ſame Amount?

Anſwer, 50 Years.

57. What muſt a perſon give for £646 12s *South-Sea Annuities*, at £124 ¼ *per Cent?* *Anſ.* £803 8s.

58. What is the Compound Intereſt of £450 10s for 8 Years at £4 *per Cent. per Annum?*

Anſwer, £166 — s 9 ½d.

59. What

59. What is the preſent Worth of £640 4*s* 3*d* due 3 Years and 234 Days hence at £4 $\frac{1}{2}$ *per Cent. per Annum*, Compound Intereſt? *Anſ.* £545 8*s* 1 $\frac{1}{4}$*d*.

60. What will £200 amount to in 1 $\frac{3}{4}$ Year at £4 *per Cent. per Annum* Compound Intereſt, ſuppoſing the Intereſt payable quarterly? *Anſ.* £214 8*s* 6 $\frac{1}{4}$ +.

61. At what Rate *per Cent. per Annum* Compound Intereſt will £230 amount to £413 —*s* 11 $\frac{1}{4}$*d* in 12 Years? *Anſwer*, £5 *per Cent.*

62. What is the Diſcount of £260 10*s* due 4 Years hence at £4 $\frac{3}{4}$ *per Cent. per Annum* Simple Intereſt? *Anſwer*, £41 11*s* 10*d* — $\frac{88}{119}$.

63. Admit a Tradeſman ſell Goods to the Value of £140 10*s* 6*d* to be paid in manner following, *viz.*

£ 50, 30, and the reſt } at the End of { 3, 5, 8 } Months

Quere the preſent Worth of the whole, allowing Diſcount at £6 $\frac{1}{2}$ *per Cent. per Annum?*

Anſwer, £136 8*s* 4 $\frac{3}{4}$*d* +.

64. Suppoſe *Thomas* owes *Richard* £200 to be paid in manner following, *viz.*

£ 80, 60, 40, and 20 } at the End of { 2, 2 $\frac{3}{4}$, 3 $\frac{1}{2}$, 4 $\frac{3}{4}$ } Years

Quere the equated Time for payment of the whole?

Anſwer, 2 $\frac{4}{5}$ Years.

65. Suppoſe a perſon be under an Agreement to diſcharge a Debt in the following manner, *viz.*

$\frac{1}{3}$, $\frac{1}{4}$, and the Remainder } at the End of { 10, 16, 20 } Months

Quere the equated time for Payment of the whole?

Anſwer, 15 $\frac{2}{3}$ Months.

66. Suppoſe a Clothier buys Goods to the value of £300 and by Agreement is to pay the ſame at the End of 4 Months, Now admit he pays £60 in hand in order to procure a longer time for the Payment of the remainder. In what time ought the remainder to be paid? *Anſwer*, 5 Months.

67. Suppoſe four perſons *A*, *B*, *C* and *D* purchaſe an Eſtate and agree that *A* ſhall pay $\frac{2}{5}$ of the Purchaſe Money, *B* $\frac{3}{15}$, *C* $\frac{1}{6}$ and *D* the reſt, *viz.* £2800. *Quere* the Purchaſe Money, and what muſt *A*, *B* and *C* reſpectively pay, and alſo what part of the Eſtate muſt *D* have?

Anſwer, Purchaſe Money £12000 whereof *A* muſt pay £4800, *B* £2400 and *C* £2000, and *D* muſt have $\frac{7}{30}$ of the Eſtate.

68. Suppoſe 3 Reapers *A*, *B* and *C* reaped a certain Number of Acres for £5 8*s* and that they wrought ſuch Parts as are hereafter mentioned, *viz.*

$$\left.\begin{matrix} A \\ A \\ \text{and } B \end{matrix}\right\} \text{ and } \left\{\begin{matrix} B\ \frac{1}{2} \\ C\ \frac{5}{6} \\ C\ \frac{2}{3} \end{matrix}\right\} \text{ of the Work}$$

Quere what muſt each Man receive to be paid in proportion to his Work? £ *s* *s* £ *s*

Anſwer. *A* 1 16, *B* 18 and *C* 2 14.

69. Suppoſe *A*, *B* and *C* purchaſed a Machine for £120 and the Profit thereof by agreement to be divided amongſt them in Proportion to the Sums they reſpectively paid which were as follow, *viz.* for every £8 *A* paid, *B* paid £5 and *C* £3, Now ſuppoſe they clear £40 *per Cent*. What is each perſon's Stock with reſpect to the Sum paid and Gain *per Cent*?

Anſ. *A*'s Stock £150, *B*'s £93 15*s* and *C*'s £56 5*s*.

70. Suppoſe 15 Men, 20 Women and 12 Servants, were to pay 30*s* and that for every 8*d* a Man pays, a Woman muſt pay 5*d* and a Servant 3*d*. What muſt each perſon pay? *d*

$$\left.\begin{matrix} \textit{Anſ.}\ 11\ \frac{1}{11} \\ 7\ \frac{1}{32} \\ \text{and}\ 4\ \frac{7}{32} \end{matrix}\right\} \text{each} \left\{\begin{matrix} \text{Man's} \\ \text{Woman's} \\ \text{Servant's} \end{matrix}\right\} \text{Share.}$$

71. Suppose *A* and *B* made a joint Stock and that *A*'s Money lay $2\frac{1}{4}$ Years and *B*'s but $1\frac{1}{4}$ Year. Now if *A* advanc'd £240 10*s* towards the Stock. What must *B* have advanc'd thereto in order to have an equal Share of the Gain?

Answer, £432 18*s*.

72. Suppose four Persons enter'd into Partnership and gain'd £180, and that *A* put into the Stock

	£		
	80		6
B	90	for	10 Months
C	100		14
and *D*	110		16

Quere each Person's Share of the Gain?

		£	*s*	*d*
Answer,	*A*'s	19	—	$7\frac{1}{4}\frac{137}{217}$
	B's	35	13	$7\frac{3}{4}\frac{115}{217}$
	C's	55	10	$1\frac{1}{2}\frac{78}{217}$
and	*D*'s	69	15	$7-\frac{124}{217}$

Share

73. Suppose *A* and *B* enter into Partnership and that *A* puts into the Stock £30 for 8 Months. *Quere* how long must *B*'s £40 continue therein in order to have an equal Share of the Gain?

Answer, 6 Months.

74. Suppose *A* hath 80 pair of Stockings worth

s	*d*		
2	6	a pair	ready Money
but 3	2		in barter

and that *B* hath Worsted worth 1*s* 7*d* a pound ready Money. Now if these two Persons barter. How much Worsted must *B* give *A* for the 80 pair of Stockings?

lb.

Answer, $126\frac{6}{19}$.

75. Suppoſe *B* a Butcher in order to clear £40 on a Bargain with *D* a Drover rates a certain Number of Lean Cows at £5 | a piece
which coſt him but £4 |
and that the Drover being apprized of that, raiſes the price of his Fat Cows which coſt £10 a piece to an adequate price. *Quere* the Number of Fat Cows the Drover muſt deliver to the Butcher?

Anſwer, 16 Fat Cows for 40 Lean Ones.

76. Suppoſe *A* hath Woollen Cloth worth

l	*d*			
5	–	} a Yard	{	ready Money
but 6	6		{	in barter

and wou'd barter 60 Yards of this Cloth with *B* for Wheat at 8*s* 6*d* a Buſhel but wou'd be willing to abate £15 *per Cent.* to have *half* ready Money. *Quere* the ready Money Price of a Buſhel of this Corn, and how much muſt be delivered, paying one half ready Money?

s *d*
Anſwer, 6 6 $\frac{1}{4}$ $\frac{11}{17}$ the Price of a Buſhel, and 19 $\frac{1}{2}$ Buſhels to be delivered.

77. Admit a Perſon ſold a Horſe for 20 Guineas and loſt thereby £24 *per Cent.* How much ought he to have ſold the Horſe for, in order to have gain'd as much *per Cent.* as he coſt him?

£ *s* *d*
Anſwer, 35 5 3 $\frac{3}{4}$ $\frac{345}{361}$.

78. Suppoſe a Perſon bought a Hog for 30*s* and that the fattening of which coſt $\frac{2}{5}$ of what he was ſold for, and that by ſelling him at 4*d* $\frac{3}{4}$ *per lb.* there was gain'd as much as he coſt at firſt. *Quere* the Weight and what he was ſold for? *lb.*

Anſwer, £5, and the Weight 252 $\frac{12}{19}$.

79. Sup-

80. Suppoſe a Perſon bought a parcel of Hops at 11$d\frac{1}{2}$ *per lb.* but not proving good Ones is willing to ſell them ſo as to loſe £10 *per Cent.* How much *per lb.* muſt they be ſold for?

Anſwer, 10 $\frac{1}{4}\frac{2}{5}$ *d*.

81. If by ſelling Goods at £2 12*s* *per* Cwt. there be gain'd £20 *per Cent.* What wou'd have been gain'd *per Cent.* if they had been ſold at £3 15*s* *per* Cwt?

Anſwer, 73 1 6 $\frac{1}{4}\frac{11}{15}$.

82. *John* ſold his Horſe for fifteen pound,
And loſt juſt twelve * *per Cent.* * £
But ſhou'd have cleared as he found,
Fifteen † by juſt Account. † £ *per Cent.*
Then how much under Value ſay,
Has *John*'s fine Horſe been ſold?
Come *Tyro* tell without Delay,
You'll this with eaſe unfold.

Anſwer, 4 12 — $\frac{1}{2}\frac{2}{11}$.

83. If a Draper ſold Cloth at £5 6*d* a Yard, and gain'd £8 *per Cent.* thereby. What wou'd he have gain'd *per Cent.* if he had ſold it at 6*s* 4*d* *per* Yard?

Anſwer, 24 7 3 $\frac{1}{4}\frac{1}{11}$.

84. In 135 Crowns, 34 Sols. How much Sterling at 2*s* 7$d\frac{3}{4}$ *per* Crown?

Anſwer, 17 18 8 — $\frac{29}{30}$.

85. Sup-

85. Suppose a Merchant at *London* remit to *Amsterdam* two Bills of Exchange each £300

		s	d	
the one	at	33	4	Flemish *per* £ Sterling.
and the other	at	33	7 ½	Flemish *per* £ Sterling.

How many Guilders *Bank* how many *Current* Money and are contained therein, *Agio* at 4 ⅜ *per Cent?*

	Guilds.	*Stiv.*	*Pen.*		
Answ.	6026	5	—	*Bank*	Money.
and	6289	17	15 ½	*Current*	Money.

86. Admit a Merchant to be under a Necessity to exchange £140 *Sterling* for Dollars or Crowns and is offered

			s	d			s	d	
and	the	Dollars	4	6	a piece	which are worth	4	3	a piece
	the	Crowns	5	—	a piece	which are worth but	4	8	a piece

The Question is which he must take to lose the least Money by, and how many of that sort must he receive?

Answer, 622 ⅔ Dollars.

If 4	Yards of	Cloth	be worth	7	Yards	of	Fustian
5	Yards of	Fustian	be worth	9	Yards	of	Shalloon
3	Yards of	Shalloon	be worth	4	Yards	of	Flannel
and 2	Yards of	Flannel	be worth	2 pair		of	Gloves

Then how many Yards of Cloth wou'd be worth 30 pair of Gloves? *Answer*, 7 ½ Yards.

87. If a Goldsmith melt the following Quantities of Gold together, *viz.*

8	*oz.* of	20	Carats fine
16	*oz.* of	17	Carats fine
and 18	*oz.* of	21	Carats fine

Quere the fineness of the Composition?

Answer, 19 ⅐.

88. If

88. * If a Vintner were to mix the following Wines, *viz.*

			s	*d*	
Canary			2	4	
Malaga	} at	{	2	8	} *per* Quart
and Sherry			1	8	

with Water, ſo that the Mixture may be worth 2*s* a Quart. How much of each ſort muſt he take?

Anſwer, 1 Quart, 1 Quart, and 6 Quarts, and 2 Quarts } of { Canary, Sherry, Malaga, Water.

89. * Suppoſe a Grocer mixes 30 ℔ of Sugar at 4*d per* ℔, with three other ſorts at 5*d*, 7*d* and 8*d per* ℔, and charges the ſame at 6*d per* ℔. What wou'd the Weight of the Mixture be? *Anſwer*, 90 ℔.

90. * Admit a Grocer wou'd mix four different ſorts of Tea, *viz.* at 5*s*, 6*s*, 7*s* and 9*s per* ℔, in order to ſell the whole Mixture of 80 ℔ at 8*s per* ℔. How much of each ſort muſt he take?

Anſwer, 8 $\frac{8}{9}$ ℔ of each of the three firſt ſorts, *viz.* at 5*s*, 6*s* and 7*s* and 53 $\frac{1}{3}$ ℔ of that at 9*s* } *per* ℔.

* *Note* Theſe three Queſtions, *viz.* 88, 89 and 90 are indeterminate and will admit of various Anſwers each, as may be ſeen in *page* 398.

91. Suppoſe a Debt is to be diſcharged at ſix different Payments in Arithmetical Progreſſion, and that the firſt Payment is to be £4 and the laſt £80. *Quere* the whole Debt and what each Payment muſt be?

	£	£ *s*	£ *s*	£ *s*
Anſ. £252 the whole Debt =	4 +	19 4 +	34 8 +	49 12

£	*s*	£
+ 64	16 +	80 the ſix different Payments.

92. Admit

92. Admit a Poſt to ride at the rate of 9 Miles an Hour, and that a perſon follows him in a progreſſive Motion riding $\left.\begin{matrix}3\\5\\7\end{matrix}\right\}$ Miles the $\left\{\begin{matrix}1ſt\\2d\\3d\end{matrix}\right\}$ Hour and ſo on increaſing every Hour 2 Miles. In what Time wou'd the Poſt be overtaken? *Anſ.* 7 Hours.

93. Suppoſe a Perſon went a Journey, and rode $\left.\begin{matrix}6\\\text{and }50\end{matrix}\right\}$ Miles the $\left\{\begin{matrix}firſt\\laſt\end{matrix}\right\}$ Day and increaſed his Journey every Day 4 Miles. How many Days did he travel? *Anſ.* 12 Days.

94. Suppoſe a young Spark on meeting a Goſſard driving 17 Geeſe aſk'd him the Price of 'em, and that the Goſſard (not caring to give a direct Anſwer) told him if he wou'd pay for the firſt Gooſe one Farthing and double it to the 16th, the 17th he ſhou'd have in at the Bargain. Now if the Spark had agreed to this propoſal, pray what wou'd they have been ſold for a Piece one with another?

Anſwer, £4 -s $3\frac{3}{4}d$.

95. In a Town lives a Cobler call'd *comical John*
An excellent Artiſt at cracking a *Pun*.
It happen'd one Day, at the Sign of the *Trunk*,
He met with a jovial young Farmer half drunk.
Who was rattling much of *Arithmetic Rules*
Making People around look like *Ninnies*, or *F—s*.
Says the Cobler —Sir I've a Coat you may ſee,
Perhaps as old faſhion'd as any there be.
At which are five dozen plate Buttons all fair,
Which I gladly wou'd ſell, as the Times you know are
Very tight, that a poor Man can ſcarce earn his Bread,
Tho' he toil 'till his Teeth all drop out of his Head.
The Farmer he liſten'd to hear the Man's Tale,
And gave him to drink a full Bumper of Ale.

The

Then aſk'd him the price of the Buttons he'd ſell,
What they're worth ſays the Cobler I cannot now tell.
But if ev'ry Button you'll treble for me,
With one Barley Corn * then the Buttons ſhall be,
Your own—To this Bargain the Farmer agreed
And began to count up the whole Number with ſpeed.
But to his Surprize found he's bilked indeed.
For the Barley Corns growing upon all his Land,
Were nothing to what was the Cobler's Demand.

Quere the Number of Barley Corns, and Number of Buſhels and alſo what it will amount to at 4*s* 4*d*. a Buſhel allowing 681 Grains of Barley to an Ounce, 16 Ounces to the pound, and 50 pounds to the Buſhel (that is to ſay) 544800 Grains to every Buſhel ?

Anſwer 211955791376081017571472166oo Barley Corns, *viz. twenty one thouſan one hundred and ninety five millions of millions of millions of millions, five hundred and ſeventy nine thouſand one hundred and thirty ſeven millions of millions of millions, ſix hundred and eight thouſand one hundred and one millions of millions, ſeven hundred and fifty ſeven thouſand one hundred and forty ſeven millions, two hundred ſixteen thouſand and ſix hundred*, which at 544800 Grains to the Buſhel make 389052480499414496276561/2 1/4 3/4 Buſhels, *viz. thirty eight thouſand nine hundred and five millions of millions of millions, two hundred and forty eight thouſand and forty nine millions of millions, nine hundred and forty one thouſand four hundred and forty nine millions, ſix hundred and twenty ſeven thouſand ſix hundred and fifty ſix Buſhels and a little more than a Peck*, which at 4*s* 4*d* a Buſhel amount to £842947041082064741932511*s* 1 1/2*d*, in words, *eight thouſand four hundred and twenty nine millions of milli-*

* *i. e.* One Barley Corn for the *firſt Button*, 3 for the *ſecond* and ſo on, trebling each time to the *laſt*.

ons

ons of millions, four hundred and ſeventy thouſand four hundred and ten millions of millions, eight hundred and twenty thouſand ſix hundred and forty ſeven millions, four hundred and nineteen thouſand three hundred and twenty five pounds, eleven ſhillings and three halfpence, which Sum is ſo *very great* that if it were poſſible for *nine hundred thouſand men* to pay *each, nine hundred thouſand pounds a day*, they wou'd (at that *great daily Sum* and at 365 Days to the Year) be more than *twenty eight millions five hundred and eleven thouſand ſix hundred and fifty Years*, in paying the ſame ——*SUCH IS THE AMAZING POWER OF NUMBERS!*

96 Ingenious *Tyro* tell me pray,
How many diff'rent hands there may
(Of Cards) be held at th' Game of Whiſt?
But pray in *Gaming* don't perſiſt.

This Queſtion is the ſame as if one were to aſk how many different Parcels of 13 in each Parcel, may be taken out of 52, *i. e.* how many Combinations of 13 in 52?

Anſwer, 635013559600.

97. Suppoſe three Timber Merchants *A*, *B* and *C*, bought a Parcel of Timber for £340 11*s* 6*d* and that

A paid $\frac{1}{3}$ and *B* $\frac{1}{5}$ } as much as { *B* / *C*

Quere what did each pay?

Anſ. *A* paid £ 17 18 *s* 6 *d*, *B* 53 15 6, and *C* 268 17 6.

98. Admit a Perſon paid a Debt of £45 with Guineas and Moidores, and that for every Moidore he paid 3 Guineas *Quere* the Number of each?

Anſwer, 30 Guineas and 10 Moidores.

99. Admit

99. Admit a Farmer paid £4 8*s* amongſt his Labourers in manner following *viz.*

to every { Man 12, Woman 6 } *d*
and to every Boy 4

and that } for every { Boy } there were { 2 Women
and } { Woman } { 3 Men.

Quere the Number of each?

Anſwer, 12 Boys, 24 Women, and 72 Men.

100. Suppoſe a Gentleman as he rode through a Village obſerv'd the people erecting a May-Pole and that upon his aſking the Height was anſwer'd, that if

and $\frac{2}{3}$, $\frac{5}{12}$ } of the Height { be multiply'd by 6, deducted from that Product

the remainder will be 215 Feet. *Quere* the Height?

Anſwer, 20 Yards.

101. Suppoſe a Perſon on being aſked what o'Clock it was replied, the Hour is

and if $\frac{1}{5}$ of the { Minutes } { ſince the Clock did ſtrike were multiply'd } by { 6 and that Product divided } by { 8, the

Quotient wou'd be 30. *Quere* what o'Clock it then was?

Anſwer, 40 Minutes paſt 8.

102. Admit a Perſon bought 100 Sacks of Flour of two Sorts for £92, *viz.*

60 } Sacks of a { fine }
and 40 } { coarſe } Sort

and that } he paid for each of the { 60 } Sacks
$\frac{1}{4}$ more than what } { 40 }

Quere, what did he pay a Sack for each?

Anſwer, £ 1 – } a Sack for the { fine }
and – 16 } { coarſer } Sort.

103 Admit

103. Admit a Grocer wou'd mix two sorts of Tea together, *viz.*

$$\left.\begin{matrix}\text{the one}\\ \text{and the other}\end{matrix}\right\}\text{Sort at}\left\{\begin{matrix}s & d\\ 4 & 6\\ 5 & 8\end{matrix}\right\}\textit{per}\ \text{lb}$$

and wou'd have the whole Mixture to to weigh 40 lb and be worth £9 17*s* 6*d*. How much of each Sort must he take for that purpose?

$$\textit{Answer},\left\{\begin{matrix}lb.\\ 25\\ \text{and}\ 15\end{matrix}\right\}\text{at}\left\{\begin{matrix}s & d\\ 4 & 6\\ 5 & 8\end{matrix}\right\}\textit{per}\ \text{lb}.$$

104. A Farmer once his Lab'rour set
A Job——twelve days to do——
And sixteen pence *per* day he'd give,
But then 'twas order'd so,
That *John* shou'd forfeit eight pence, for
Each Day that e'er he play'd,
Because he apt to fuddle was,
So was the Bargain made.
At last just half a Guinea he
Receiv'd.——Then tell me pray,
What Days he work'd, what idle was?
Do this without delay.

$$\textit{Answer},\left\{\begin{matrix}\text{Work'd}\ 9\frac{1}{4}\\ \text{and Play'd}\ 2\frac{3}{4}\end{matrix}\right\}\text{Days.}$$

105. Suppose a person receiv'd a Legacy of £150 in Six-and-thirties, Moidores and Guineas

$$\text{and}\left\{\begin{matrix}\text{that the whole}\\ \text{the Guineas}\ \frac{1}{5}\ \text{of}\\ \textit{Quere}\end{matrix}\right\}\text{the}\left\{\begin{matrix}\text{Number of}\end{matrix}\right\}\left\{\begin{matrix}\text{Pieces were 100}\\ \text{Moidores.}\\ \text{each?}\end{matrix}\right.$$

Answer, 40 Six-and-thirties, 50 Moidores and 10 Guineas.

106. If

106. If $\frac{2}{3}$ of my Age be added to $\frac{3}{7}$ thereof, and that { Sum multipli'd / Product divided } by { 12 / 6 / 9, the remainder and that Quotient made less } will be 83 *Quere* my Age at the time of making this Question?

Answer, 42 Years.

107. Th' Age of a Lady you quickly may find,
From what you obſerve * hereunto's ſubjoin'd.

* The Square of her Age being multiplied by it's Cube and that Product divided by 320, the Square Root of the Quotient will be 100.

Answer, 20 Years.

New ARITHMETICAL PARADOXES *for the Amuſement of Youth.*

PARADOX I.

ONE and *two*, when they're wrote down fair,
Will make *one hundred* I declare.

PARADOX 2.

Take *one* from *nineteen*, th' remainder you'll ſee
Is *twenty* exactly, pray how can this be.

PARADOX 3.

Prime numbers *four*, ſo wrote may be,
Juſt *eighty eight*, their ſum you'll ſee;
But if from *eighty eight* you take
One o'th' numbers, then th' ſum will make
No more (I ſay) than *eighty three*,
Pray tell me how this thing can be?

PARADOX 4.

The ſum of *four* figures in value will be,
Above *ſeven thouſand, nine hundred* and *three*;
But when they are halved, you'll find very fair,
The ſum will be *nothing*, in truth to declare.

PARADOX 5.

The ſum of *nine* figures, a number will make,
From which if juſt *fifty* you're pleaſed to take,
One third of that number remains ſtill behind,
This number young *Tyro* be pleaſed to find?

PARADOX 6.

Six hundred and *ſixty* ſo order'd may be,
That if you divide the whole number by *three*,
The quote will exactly in numbers expreſs,
The half of *ſix hundred* and *ſixty* not leſs.

PARADOX 7.

Come tell to me, what figures *three*,
When multipli'd by *four*,
Make *five* exact, 'tis truth in fact,
This *Tyro* pray explore?

PARADOX 8.

George paid his *Uncle* as we find,
One hundred pounds juſt to his mind;
To his *firſt Couſin Simon Reade*,
Juſt the ſame ſum he likewiſe paid;
But had in caſh at firſt not more,
In *Britiſh* pounds, than juſt *five ſcore*,
How this cou'd be, I pray explore.

PARADOX 9.

Juſt *one pound ten* * will name a *Man*, * *ſhill.*
His *Sign* likewiſe, 'tis not the *Swan*:
Come tell this *Landlord's Name* and *Sign*,
That *John* may know to call and dine.

PARA-

PARADOX 10.

A famous *Quack Doctor*, of ſkill moſt profound,
Receiv'd of his patients juſt *one hundred pound*,
It being in ſilver, bids *Merry* his man,
To count it him over, as ſoon as he can;
He counted the money, then *Maſter* quoth he,
Here's *one hundred* for *you*, and *ſomething* for *me*,
You're wrong, (ſays the *Doctor*) that never can be.
But ſoon he perceived his money made more,
By *Merryman's* method of counting it o'er:
So liking the fancy, ſaid, take what remains,
It was more than *eight pounds* he got for his pains.
How *Merryman* counted the money declare,
To gain ſuch a ſum from *one hundred pound*—fair.

PARADOX 11.

Twelve *merry Men* did in my garden ſtand,
All in a row, upon this fertile land.
At equal diſtance plac'd—the row in view,
Was *twenty yards* in length, when meaſur'd true,
Theſe Men replac'd,—ſtand in a row once more,
At the *ſame diſtance*, as they were before.
The length of ground, on which they fairly ſtand,
Is now no more than *thirteen yards* of land,
How is this done, come *Tyro* tell to me,
And with a *Laurel* you ſhall crowned be?

PARADOX 12.

How in two parts muſt I divide
A board that's juſt *nine inches* wide,
And *ſixteen* long, I pray declare,
To fill a hole juſt *one foot* ſquare.

CONCLUSION.

To the *Tyro*'s in ARITHMETIC.

YE *Britiſh* Youths, with emulation ſtrive,
And to this Port, or Page, you'll ſoon arrive.
The track ſo eaſy, ev'ry Rule ſo clear,
Nought can obſtruct you to your Paſſage here.
No dang'rous Cliff, no Cape to weather round,
Quite ſmooth and eaſy, ev'ry Courſe is found.
That with delight you may the Harbour gain,
Where *Knowledge* ſpreads her Sails, & wafts the Main,
With golden breezes, to enamour Youth,
To catch the Gales of Reaſon, Senſe and Truth.
Knowledge! that dear refiner of the Soul,
Bids thought take wing, and fly beyond the Pole,
High thro' the Clouds, to ſoar above the Sky,
And prove Creation in a *Deity*.
Knowledge! (like *Ariadnes'* thread) leads thro',
Lab'rinths of Learning, Studies ever new.

FINIS.

ADVERTISEMENT.

THE *Author* of this *Treatiſe* begs leave to return his ſincere Thanks to all thoſe *Ladies* and *Gentlemen* (in Number above eight hundred) who have been pleaſed to become Subſcribers thereto, and hopes they will excuſe him for not publiſhing their Names as he at firſt propoſed, being prevented therefrom by the Book being carried to a greater Size than the Price fixt upon it will bear, having, in order to render every thing complete, extended its length above

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